

ELECTRONICS

Australia

**HIFI
NEWS**

MARCH, 1975
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The stylish PS-5520 features automatic/manual stereo turntable system, 30 cm aluminium diecast platter, faithful and flawless reproduction.

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Turntable: 30 cm (12") aluminized diecast alloy. **Speeds:** 33 1/3 rpm and 45 rpm. **Output voltage:** 4 mV at 1 kHz 5 cm/sec. **Signal-to-noise ratio:** 63 dB (DIN). **Stylus force:** 2 g. **Stylus:** Conical 0.5 mil diamond. **Power requirements:** AC 240 V, 50 Hz. **Dimensions:** 450 (W) x 175 (H) x 395 mm (D). **Weight:** 8.3 kg.

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ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 36 No 12

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The temperamental type are you? Prone to get hot under the collar? Then this temper timer could be just what you need. In addition to helping you control that nasty temper, the unit may be used as a counting aid or as a conversation piece at parties. Full constructional details commence on page 54.

FREE IN NEXT MONTH'S ISSUE:

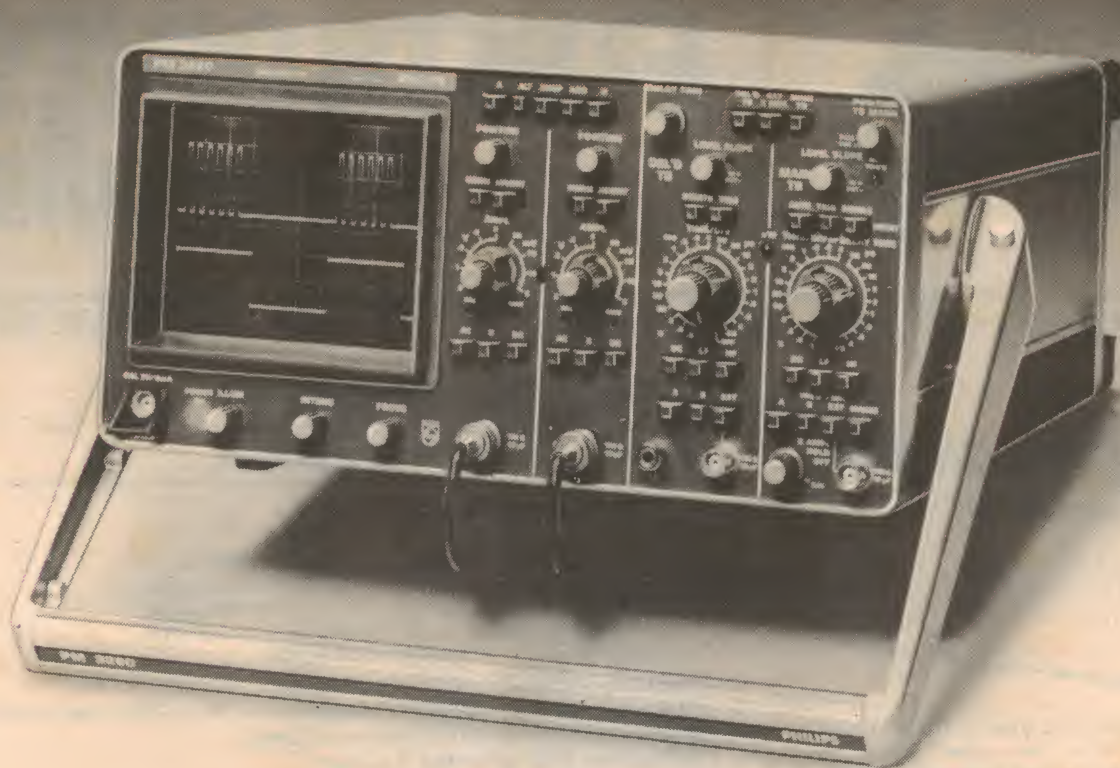
Dick Smith Electronics'
64-page manual/catalog

1975 EDITION

More than ever before, invaluable as a source of information on the availability and use of electronic components and equipment. So don't miss our April issue!

On the cover

Our cover this month depicts the main production control room at GTV 9, Melbourne. The colour test pattern shown has been broadcast by GTV 9 since October last year as an aid to colour TV installation technicians, and is typical of those now being transmitted using an electronically generated circle. Our article on page 50 explains how to use this and other test patterns to adjust colour TV receivers. (Photograph courtesy GTV 9, Melbourne.)



Three big differences. 120 MHz, 9kg and a logical layout.

This oscilloscope does the job.

The job being servicing, testing and developing communications and computing systems.

For this you need a bandwidth of at least 100 MHz in order to keep ahead of component developments like Schottky TTL.

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And a logical front panel layout is equally important since it lets you take measurement easier, quicker and with less possibility of error.

(One example of our logic is the separation of main and delayed time base controls in order to avoid any ambiguity.)

Even more

As well as these obvious benefits, the new PM 3260 has even more significant features like: the clean display, even at the highest writing speeds; the wide use of thin film circuits that help the space and weight reduction and that increase overall reliability;

the specially developed power supply that accepts any line voltage frequency and DC and that dissipates only 45 W, thereby eliminating the need for a fan (and associated filters); and finally, the modular

construction that gives fast access to all boards, controls and components.

First in a family

The new PM 3260 is also the first in a new series of oscilloscopes that will soon include higher and lower bandwidth instruments having storage and multiplier facilities — all with the same important benefits of high performance, light weight and excellent ergonomic design.

To find out more about the first in the family, contact: Test & Measuring Dept. Philips Scientific & Industrial Equipment G.P.O. Box 2703 Sydney 2001

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Editorial Viewpoint

In less than fifty years . . .

This month sees the official inauguration of colour television in Australia. From now on, colour will be the rule on all channels, rather than the exception.

I cannot witness an occasion such as this without pausing to consider how far electronics has progressed in my own lifetime, and that of my contemporaries.

As a lad, I lived in a town in which radio was unknown. I can remember the arrival of the first "wireless" and the spirited arguments that followed about the relative merits of this complicated gadget and the good old reliable wind-up phonograph.

I can remember sitting in a family circle and sharing a few magic moments as the earphones were passed around during broadcasts—all the way from Sydney. And the arrival of the first Brown's "Table Talker", which allowed us all to listen at once—provided we didn't shuffle or cough!

I remember the early clumsy efforts to eliminate the messy and costly batteries, and the subsequent technical revolution that transformed the wireless from a gadget to a piece of furniture: one that supplanted the phonograph and then brought about its rebirth in another form.

Looking back, one can see that wireless was a vital ingredient in a profound social revolution, but it was so protracted that it seemed to be merely a part of the changing scene, rather than one of its root causes.

Not so with television. When it came to Australia, it changed the pattern of family and social life within a matter of months. Radios, books, records were put aside. The spell of Hollywood was broken and hundreds of prosperous theatres were suddenly deserted. Only recently has the lure of "the box" started to wane.

Now the box has taken to itself colour. And, despite the atrocious "demonstrations" provided by department stores across the nation, let me assure you that it's very good colour. This new-look television, in full colour, intimate, with an ever increasing freedom of expression, will extend further the impact of the medium.

But what gets to me at this moment is not the social aspect, important as it undoubtedly is. It's the realisation that, within one person's experience, we have come from an era when there wasn't a single wireless within a dozen miles, to high definition television in full colour.

And if you don't care for television? Then you can turn to FM/stereo radio, or to quadraphonic sound from disc or tape!

Neville Williams

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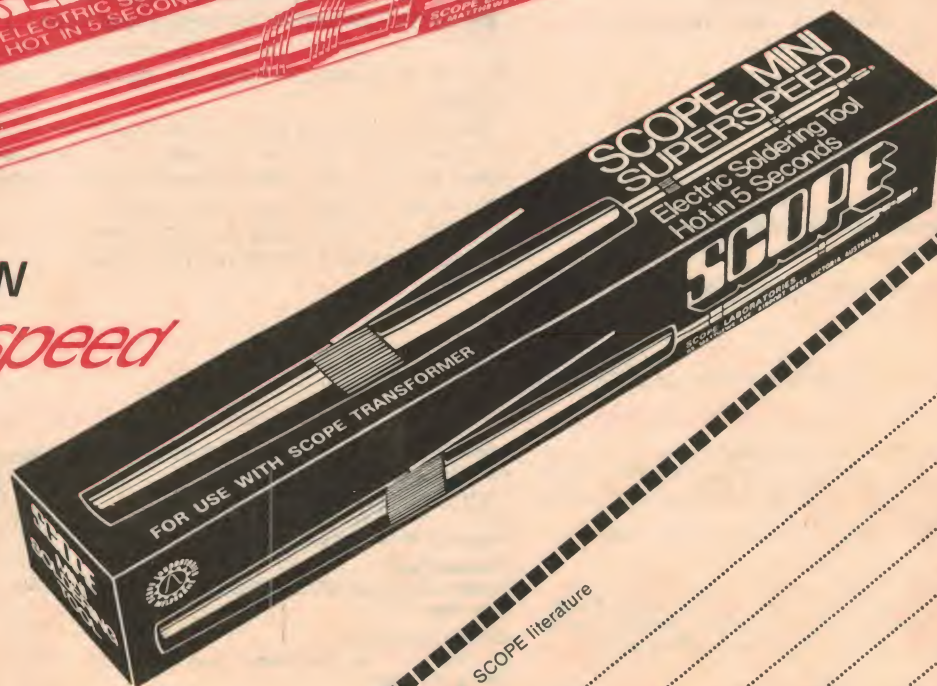
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there's no point trying to rumble a THORENS rumble.



Thorens TP-16 tone arm, showing magnetic anti-skating device.



Typical Thorens belt drive assembly.



Thorens model TD-125 Mk. II.



Cut away view of Thorens 16 pole synchronous motor.

THORENS

Detecting a Thorens rumble is nigh impossible; after almost 50 years continuing development Thorens adhere firmly to the belt drive principle. This policy is endorsed by the numerous reviewers and dedicated audio enthusiasts — *all over the world* — who use Thorens turntables in preference to all others. It's not surprising to find Thorens regarded as Europe's finest turntable.

Three models are now available throughout Australia:—

THORENS TD-125 AB Mk. II ELECTRONIC TRANSCRIPTION TURNTABLE

A precision instrument with electronic speed control, three speeds (16, 33 $\frac{1}{3}$, 45 rpm), and a run-up time of just one

second. Incorporates the TP-16 tone arm with its unique magnetic anti-skating bias adjustment.

RECOMMENDED CARTRIDGE: Ortofon M 15 E SUPER.

Weight: 5 grams. **Frequency response:** 20-20,000 Hz. (20-10,000 Hz \pm 1 dB). **Channel separation:** 25 dB. Elliptical stylus.

THORENS TD-160C TRANSCRIPTION TURNTABLE

Two speeds, 33 $\frac{1}{3}$ and 45 rpm. 16 pole two phase synchronous motor. Shares many design features with the TD-125 Mk. II. Fitted with TP-16 tone arm, magnetic anti-skating.

RECOMMENDED CARTRIDGE: Ortofon F Series.

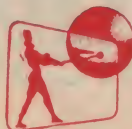
Weight: 5 grams. **Frequency response:** 20-20,000 Hz. (20-8,000 Hz \pm 1 dB). **Channel separation:** 25 dB. Four models available, with elliptical or spherical stylii.

THORENS TD-165C TRANSCRIPTION TURNTABLE

A budget priced Thorens turntable, sharing many design features with other models. 16 pole synchronous motor. Fitted with TP-11 tone arm, plumb-bob anti-skating device. Two speeds, 33 $\frac{1}{3}$ and 45 rpm. Magnetic cartridge supplied, with diamond stylus.

The combination . . . THORENS and ORTOFON . . . is very hard to beat, when it comes to quality sound reproduction. They're both great names from Europe, the source of much fine music, and equally fine audio equipment. Listen to the THORENS/ ORTOFON combination at your favourite specialist hi-fi store!

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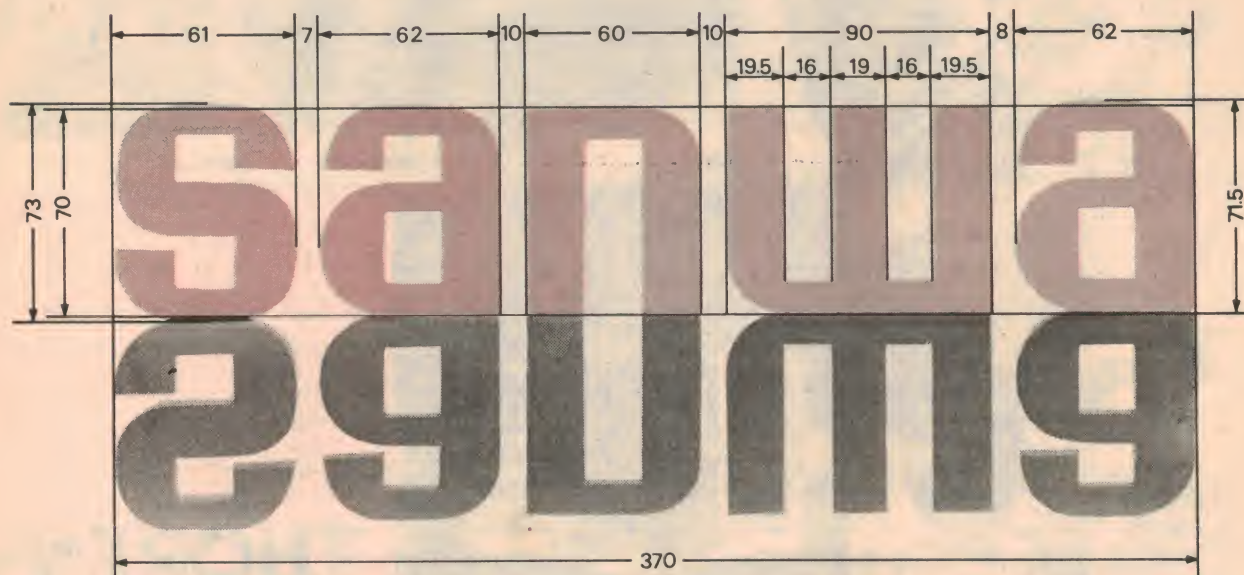
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Seventy per cent of all multitesters sold in Japan carry the Sanwa brand. Which isn't really surprising, since Sanwa multitesters have exceptional built-in capabilities. Versatility is a standard feature. So is sensitivity. And there are more than twenty-five models to choose from.

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LER 051



Hi Fi News

Coming soon: Class-A FET power amps

The sustained, low level arguments about "valve tone" versus "transistor tone" are likely to take a new turn in the foreseeable future with the development of FET power amplifiers. Power FETs would seem to combine the supposed advantages of valves with the operating efficiency of solid-state devices.

by NEVILLE WILLIAMS

When transistors arrived on the hifi scene in the 60's, there were plenty to sing their praises in terms of high available power output for comparatively modest power input, together with the elimination of the costly and bulky output transformer. For good measure, test figures showed distortion levels at least as low as from high quality valve amplifiers, while hum was way down, thanks to the elimination of heater circuitry.

But despite that, valve enthusiasts were not easily separated from their class-A or -AB1 operation, their power triodes or their ultralinear circuits. There seemed to be good basic reasons to doubt the new fangled transistor amplifiers which almost invariably operated in class-B — a mode that no valve man would use for anything more ambitious than public address!

Many valve devotees were quite convinced that they could hear the difference. They spoke disparagingly of "transistor tone" and maintained that it lacked the essential "sweetness" of valve tone. Even now, as noted on page 61 of our January issue, there is a strong pro-valve cult in Japan, which is being catered for at the million pound level by the British Lowther company.

The bias in favour of valves has not been without some theoretical justification.

In the early days of transistor design, many manufacturers were preoccupied with their ability to offer high power from modest packages, along with very low distortion near the point of overload, and low noise. It was tacitly assumed that an amplifier which was outstanding at full power would be nothing short of superb at lower levels. With valves, it had always been this way.

What gradually emerged was the realisation that the linearity of class-B output stages (now using transistors) was in-

herently very poor at milliwatt levels. Further, that negative feedback was not an adequate palliative since, in this critical region, the loop gain around under-biased transistors was at its lowest. The result was that, while many such transistor amplifiers produced good figures at high power levels, they were very poor at the low levels where much of the softer music would be found. At these low levels, an under-driven valve amplifier would indeed be far ahead of its under-driven transistor counterpart.

The lesson has been learned during the intervening years, of course, and a lot more attention is now paid to the behav-

iour of transistor power circuitry in the cross-over region, where the load is being shed by one transistor and taken up by its class-B counterpart.

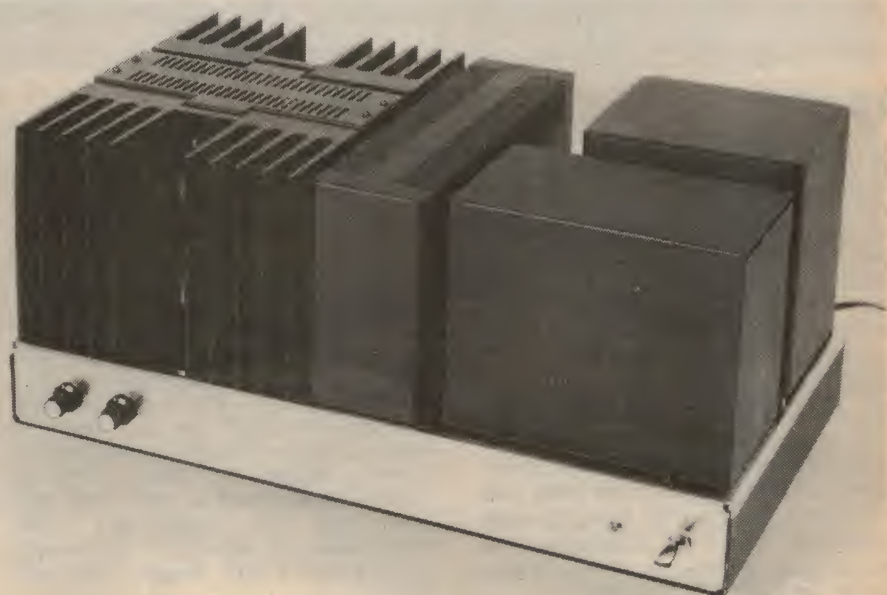
Even so, correction is a matter of degree and most designers merely nudge the standing current up far enough to minimise cross-over distortion, without getting involved in dissipation problems leading to the use of larger power transistors, larger heat sinks and larger power supply components.

Thermal runaway is another problem they have to watch, because bipolar transistors are inherently unstable in terms of temperature. As they draw more current, they become hotter; this tends to increase the operating temperature still further, and with it the current — and so on.

If bipolar power transistors are to operate reliably under a variety of service and ambient conditions, they must be protected against thermal runaway by generous heat sinks and by DC and/or thermal negative feedback.

It is because of all this that considerable interest is being shown in a high power FET (field effect transistor) pioneered by Professor Nishizawa of Tokatu University in Japan. It has been taken up by Nippon Gakki (Yamaha) under commission from the Japan Technology Development Foundation. While this group controls certain key patents, other companies such as Trio, Kenwood, Matsushita, Sony and Pioneer have all become involved in parallel research.

Although true solid-state devices, FETs have always offered a potential reversion to the essential simplicity (and familiarity) of valve circuit techniques. They have gradually emerged from being delicate and rather exotic devices to a stage where they are used as a matter of course in



Strongly reminiscent of the one-time valve approach, this basic power amplifier nevertheless represents the very latest in technology. Operating under class A conditions (or more likely, class AB) the FET power stage can deliver 150W RMS per channel (both channels driven) with a distortion of 0.1% at rated power and .04% at 1W.

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TC-377

By adding the TC-377 to your present system you can discover a new world of high-fidelity listening pleasure. Other exciting features: *Precisely engineered new Sony Ferrite & Ferrite record and playback heads. *3-head system. *Auto stop. *Servo mechanical tape back tension regulator. *Tape selector. *Microphone/line mixing facility.

Power requirements: AC 100, 110, 120, 127, 220 or 240V. **Tape speeds:** 19cm/s (7½ ips), 9.5cm/s (3¾ ips), 4.8cm/s (1⅞ ips). **Frequency response:** 20Hz-30kHz at 19cm/s. **Flutter and wow:** Less than 0.09% at 19cm/s. **Signal-to-noise ratio:** Better than 55dB. **Dimensions:** 418 (W) x 210 (H) x 392mm (D) (16½ x 8⅝ x 15⅞"). **Weight:** 11.0kg (24lb 4oz).

TC-755

The TC-755, an impressive stereo tape deck that embodies all the required features for quality recording.

*Closed-loop dual-capstan drive. *3 ferrite heads. *AC servo motor. *10½" reel capacity. *recording buttons lock for recording in the absence of the user. *Line out volume control. *3 motors.

Power requirements: AC 110, 127, 220 or 240V, 50/60Hz. **Tape speeds:** 19cm/s (7½ ips), 9.5cm/s (3¾ ips). **Frequency response:** With SLH tape 20-30,000Hz at 19cm/s. With normal tape 20-25,000Hz at 19cm/s. **Flutter and wow:** 0.05% at 19cm/s. **Signal-to-noise ratio:** With SLH tape 56dB. With normal tape 53dB. **Dimensions:** 435(W) x 451(H) x 221mm(D) (17⅞ x 18¾ x 8⅞"). **Weight:** 24kg (52lb 15oz).

TC-458

The TC-458, an advanced stereo tape deck that's really feature packed. *Auto reverse recording. *Ferrite & Ferrite heads. *Closed-loop dual-capstan drive system. *AC servo controlled motor. *Mike attenuator. *2 FETS in preamplifier. *Tape tension regulator. *Line out volume control. *Roto Bi-lateral head system.

Power requirements: AC 100, 120, 127, 220 or 240V, 50/60Hz. **Tape speeds:** 19cm/s (7½ ips), 9.5cm/s (3¾ ips). **Frequency response:** With normal tape 20-25,000Hz at 19cm/s. With SLH tape 20-30,000Hz at 19cm/s. **Signal-to-noise ratio:** With SLH tape 56dB. **Flutter and wow:** 0.06% at 19cm/s. **Dimensions:** 401(W) x 410(H) x 201mm(D) (15⅞ x 16⅝ x 7⅞"). **Weight:** 14.5kg (32lb)

*A trademark of Dolby Laboratories, Inc.

S07

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for particular people

many everyday small-signal applications, notably in the front ends of TV, FM and other VHF and UHF equipment.

The breakthrough is in their translation into high-power devices, capable of being used in the output stages of high quality audio amplifiers. It has been suggested that one of the new FETs is roughly equivalent to about eight of the once famous 2A3 tubes in parallel. Those with longer memories may recall that many 2A3s were, in turn, fabricated as two triodes in parallel, not unlike the old '45.

A pair of the new FETs in push-pull would therefore be roughly equivalent to sixteen 2A3s or thirty-two '45s!

But whereas this many valves would have presented impossible problems of cost, space, reliability, stability and heater dissipation alone, the new FETs will hopefully emerge as no more than another breed of solid state power device, and subject to the developments and economies of mass production.

Used under class-A or neo class-A conditions, the inherent open-loop distortion of a push-pull FET power stage should diminish towards the figures achieved by valves, being particularly low at low power levels, thanks to the elimination of cross-over distortion. There would be less reliance on high degrees of negative feedback and fewer problems with instability arising from high feedback around a multiplicity of stages.

Because class-A or -AB1 operation assumes a high standing current, FET stages operating in this mode will generate considerable heat with no signal input and call for a suitably proportioned power supply. While this would seem to offer no obvious advantage over ordinary transistors under similar conditions, proponents of the FET stress two offsetting factors:

One is that a push-pull FET stage requires only signal "voltage" drive, eliminating the need for the usual array of pre-output power devices — a saving both in complexity and current.

The other is that power FETs combine a high dissipation capability with a degree of thermal self-protection: a rise in temperature tends to produce a reduction rather than a rise in device current, so that they tend automatically to find a condition of temperature equilibrium. The whole heat problem is very much simplified.

A developmental amplifier which has been demonstrated by Yamaha, offers 150 watts per channel into 8 ohms, from 20Hz to 20kHz. Distortion is less than 0.3% at the extremes of the range and less than 0.1% at 1000Hz.

While these figures in themselves do not represent any kind of a breakthrough, the interesting consideration is whether distortion diminishes to "immeasurable" at low signal levels and whether this will achieve the ultimate in the opinion of the "ultra-perceptive": valve tone from a transistor amplifier!

A further, more detailed article on power FETs is currently being prepared.



Manufactured by Plessey in its long established (Rola) factory in Richmond, Vic, this PE 1000 loudspeaker system is the first of a new range to be released on the Australian market. Finished in hand-rubbed veneer, and with a removable cellular foam front, the system is seen as a quality product, without the penalty of a "quality" price tag. It uses a 25cm woofer, with aluminium voice coil, 7.6cm mid-range and an X20 horn tweeter, giving a nominal power rating of 20W RMS. It can be used free-standing or positioned horizontally on a shelf.

CASSETTE V. OPEN-REEL: With their greater track width and higher speed, open reel tapes have always had the potential for better quality than cassette tapes. But cassettes have an enormous advantage in terms of convenience, and concentrated technological effort has pushed their quality into the "adequate" class, even for the hi-fi market. As a result, cassette decks caught up with and overhauled open deck production in 1973. Last year saw cassette deck production in Japan increase by about 50% on the previous year, while open reel decks slipped by about 10%. In broad terms, for every 100 tape machines passing over the counter at the end of '74, 70 of them were cassette players!

Is the open reel machine doomed? If it is, no major Japanese manufacturer gives any hint that they think so. Their judgement seems to be that open reel decks will continue as a minority but important segment of the industry, catering for those who want the ultimate quality that the larger format can provide,

"DOLBYISED" FM/STEREO

The reservations of BBC engineers about "Dolbyising" FM/stereo transmissions is obviously not shared by US station operators. Latest published figures indicate that 61 FM/stereo stations in the US are radiating programs in which the low-level high frequency components are boosted in accordance with Dolby-B. For full fidelity the programs should be processed in receivers equipped with Dolby-B decoding but the reduced dynamic range, when tuned through an ordinary receiver, is being interpreted as an improvement!

together with the facility that it offers in editing home recordings.

CASSETTE DUPLICATOR: While cassettes provide a convenient and easy means of recording and disseminating information from seminars, conferences, etc., the job of making duplicates can be tedious, a consideration which somewhat offsets its economy. There is obviously a place for cassette duplicators that will make copies much faster than by the normal speed, one-at-a-time method—without getting into the professional mass-production field.

Philips have recognised the need for such a copier (as mentioned in Electronics Australia for January '75, page 15). Now Sony have come up with a cassette copier, capable of making up to three copies at a time, at eight times the normal speed. All four tracks are copied simultaneously, and operation is completely automatic after the master and blank tapes are loaded into the machine. Copying time for a C-60 cassette is about 4 minutes, with a rewind time of 65 seconds. Type number of the copier, by the way, is CCP-13.

Sony are reportedly planning also to market a slave copier, presumably for use with existing playing decks, and an open reel copier.

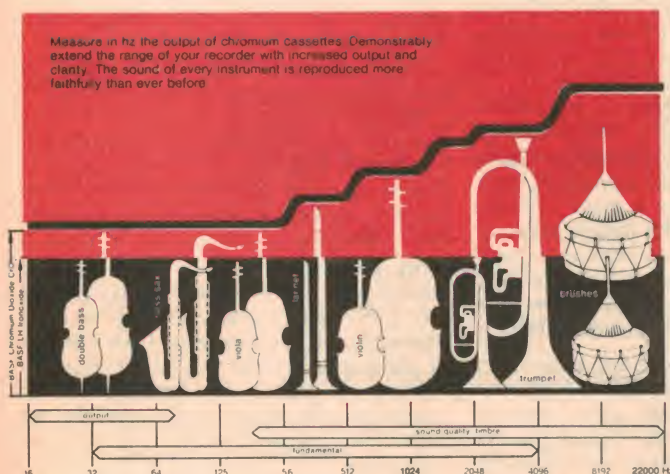
COPYING, AND COPYING! The availability of cassette duplicating equipment is important to legitimate users—people who need to disseminate copies of their own material, for a variety of reasons.

Amongst these are educational, social and religious groups to whom the cassette



BASF 'chrome' puts the polish on cassette sound

(Some say you can almost hear your face in it!)



If BASF "Chrome" (Chromium Dioxide— CrO_2) really was chrome like a Mercedes grille, you'd have a beautifully visible demonstration of what CrO_2 cassette tape can do for cassette sound.

No shadowy sound images confined to middle range frequencies. But clear, bright sound faithfully mirrored along with the highest harmonics to add that pin sharp sparkle of realism.

Check out Chromium Dioxide's superior high-range capabilities on the chart below. Or, better still, take a closer look with your own ears!

BASF "Chrome" cassettes give a polished performance every time. With Special Mechanics to smooth away wow and flutter, and the fine surface finish to minimise headwear. CrO_2 —SM Cassettes—Available from your Hi-Fi dealer in C60, C90 and C120.

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BA 4227

HIFI NEWS

has become a most important means of communication. On the trail of transistor radios, cassette players are finding their way rapidly into underprivileged and tribal communities, and regionally produced cassettes can communicate on an appropriate and personal basis.

But cassette duplication on another scale is causing a king size headache on the American show business scene. A regular commercial pre-recorded cassette, sold through normal channels, typically returns about one dollar in fees to the recording artist(s), the publisher and the American Federation of Musicians' Trust Fund. It is the means by which artists and publishers share in the returns from their own talent and initiative.

Some self-appointed entrepreneurs, however, see this royalty as the key to a fast buck. By one means or another, they duplicate recordings by big-name artists on to blank tapes, simulate the label (usually in one colour for cheapness) and offer the result as "latest hits—half price" through wayside stalls, "flea" markets and any other outlets that are available to them. Royalty obligations are ignored.

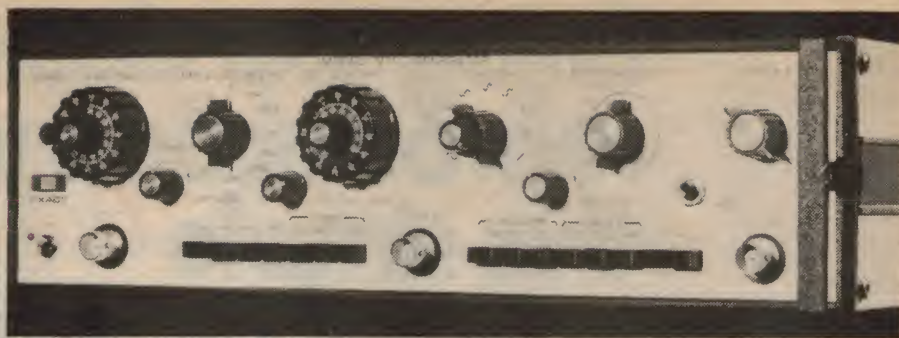
Sometimes the cassettes are straight dupes of current commercial releases copied on small machines on a pin-money basis. Some are fairly evidently copied on a larger scale. Some are assembled from old originals recorded prior to 1972 when U.S. federal copyright law was tightened to include sound recordings. This is a slight disadvantage, but not all that serious in an era when nostalgia is big time.

Whatever the background, the illicit dupes are normally second grade, copied from degraded originals and on to job-lot tape. But the profits are high. The RIAA (Recording Industry Association of America) estimates that the tape pirates cleaned up \$100 million in 1969, \$150 million in 1971 and close to \$250 million during the year just past.

Nor does the American public seem to mind all that much. If a cassette rotates, and sounds, and costs half as much, why ask too many questions?

FM ALLOCATIONS: Following all the hoo-haa in Australia about frequency allocations for VHF FM, many may have gained the impression that Australia was unique among the nations in its disregard for the "sacred" FM frequencies between 88-108MHz. In fact, however, even in the USA only segments of the total band are available in different parts of the country. Other nations have similar limitations on their VHF FM allocations.

In Britain, the Annan Committee will be looking at VHF broadcasting during the next two years with a view to securing more spectrum space. At present the frequencies 97.6 to 102.1MHz are occupied by fire, ambulance and police services, while the military occupy from there up to 104MHz. Broadcasting authorities



Pictured above is a 20MHz linear-log sweep generator, manufactured by Exact Electronics Inc. of Oregon USA. Designed to precision standards, it can produce sine, square, triangle, pulse and ramp waveforms over the range 0.0001Hz to 20MHz. One control sets the start frequency, the other the stop frequency over a three decade (1,000:1) range. Special provision is made to cover the audio range to 20kHz in one sweep, and the operator has the choice of either a linear or a log sweep. An internal sweep generator, which can be triggered externally or manually, provides a sweep period ranging from 1000sec to 100ns, while the end frequencies can be held to permit accurate setting of the sweep limits. Other facilities include positive or negative DC offset of the signal, variable phase relative to triggering, and calibrated output attenuator. The instrument measures 320mm wide x 340mm deep x 89mm high. (Further details from Jacoby Mitchell Ltd, 215 North Rocks Rd, North Rocks, NSW 2151).

would dearly like to see these services moved up into UHF region and the band extended to the full 108MHz limit. But not all the utilities are prepared to move to the UHF region and the Committee is likely to meet considerable opposition or be faced with "horse trading" of this frequency for that, possibly involving TV channels. It all has a fairly familiar ring!

ELECTRONIC PIANOS: With electronic organs already firmly established, attention seems to be turning towards electronic pianos, for those who want to develop their skills in that direction. In Japan, Nippon Columbia's instrument has been so successful that production targets have had to be revised upwards several times. Appeal of the electronic instrument lies in its lower cost, lighter weight, relative freedom from tuning worries and the fact that the player can practice for as many

hours as he/she likes, using headphones instead of the loudspeaker.

Surprisingly, electronic pianos are not in any sense a scaled down organ. "Piano" tone is difficult to synthesise electronically and, if a poor imitation, is immediately recognisable as such. In addition, much more attention has to be paid to keying technology if the instrument is to have any claim to piano "touch", with the loudness and quality of the sound related to the way the notes are actually played.

LOUDSPEAKER SIZE: Amongst the features mentioned for a new portable cassette radio is "a big 10cm speaker, for full, rich sound". That sounds quite an impressive speaker—and it may be a reasonable size for a portable set—but when the metric measure is converted to more familiar terms, it emerges as not quite 4 inches!



Designed to meet the specific requirements of the NSW Department of Education, this locally designed and produced Philips mobile listening unit contains a stereo turntable, stereo cassette unit and radio, and facilities for external input. It can feed ten pairs of headphones or two stereo loudspeakers for communal listening. Using the headphones, student groups can be involved in one subject while the rest of the class takes an entirely different lesson from the teacher. The students themselves can operate the controls. Being mobile and compact, the unit can be set up quickly where it is needed.

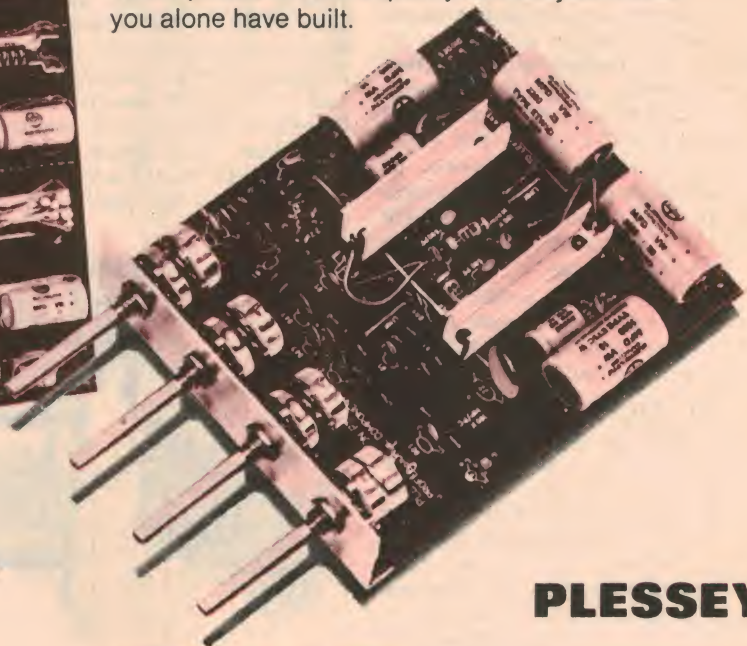
Enjoy top class stereo reproduction with this simple amplifier kit


Here at last is the "do-it-yourself" stereo amplifier kit from Plessey Ducon. This is a simple and easy to assemble kit, capable of producing truly first class reproduction from a 3-3 watt RMS integrated circuit amplifier at a cost far below that of equivalent powered units.

This kit comes complete with clearly defined assembly and testing instructions together with construction details for speaker housings, alternative input wiring for tape and radio and advice on how to choose your turntable, speakers and power transformer.

This kit has been thoroughly tested and proved and contains only the best of local and imported professional quality components.

Assemble and create your own means of music pleasure from a quality sound system that you alone have built.



PLESSEY 

Plessey Australia Pty. Limited
Components Division
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Telex: 20384

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AC 86/RI

STEREO SOUND AND STEREO BROADCASTING

In view of the current interest in Australia in FM/stereo broadcasting, this article by well known English writer, Pat Hawker, is timely. Originally published in the journal of the Independent Broadcasting Authority, it was offered by the Author to Electronics Australia.

Good sound reproduction in the home is no longer of interest only to the hi-fi buffs. Modern domestic audio and radio equipment can be good without rivalling an electronic music laboratory!

But don't make it too simple. If you do not listen in 'stereo' you are missing an important illusion of breadth and space and reality. Stereo, which comes from the Greek work 'solid', provides a more satisfying sound, whether for 'pop', jazz, drama or the classics.

When Britain's Independent Broadcasting Authority (IBR) began planning its new network of independent local radio stations, an important decision was made that may have surprised those who had thought that radio stations supported by advertising would be concerned only in catering for the mass audience.

For it was decided that, despite the purely 'local' nature of ILR, the fullest possible advantage should be taken on the VHF stations of stereophonic broadcasting with its feeling of spaciousness, rather than of a sound being funnelled through a single source.

At the time only a tiny minority of British listeners had stereo radio equipment. Even now, although the number is rising quite rapidly, possibly only one-in-ten or one-in-twenty listen to stereo broadcasting in stereo.

What a pity! For despite the recognised limitations of two-channel stereo, it still represents a worthwhile advance over conventional 'monophonic' radio.

The development of stereo took broadcasting and records out of the 'point-source' era. Today it is possible, with care (and at some extra cost) to listen to a 'sound stage', as it is called, and to receive an important part of the directional information you would expect your two ears to provide if you were present at a real performance.

With only a single channel of communication between the studio and the listener, the only 'dimension' that can be conveyed in some degree is depth: a singer, being louder, may sound as though he or she is standing in front of the orchestra. But the listener has to rely entirely upon imagination for any impression of the disposition of the actual instruments.

This would not be true at a live per-

formance where our *two* ears would be busy providing a reasonably accurate side-to-side (azimuth) localization, as well as indicating subconsciously the arrival angle in the vertical plane (zenith) and also some judgment of distance, based on echo and memory.

Over 400 years ago the Dutch composer Adriaan Willaert recognised the importance of spatial effects and placed two separate choirs, one each side of a church; some of the baroque organs were built in separate sections for this reason. The first performance of Berlioz's 'Requiem' had four complete orchestras placed in the four corners of the Dôme des Invalides. There is nothing new about the basic wish to provide breadth in music and drama.

In the modern concert hall we hear sounds reaching our ears from different directions. The violins, the brass, the percussion, each member of an orchestra sends out sound waves from the allotted place in the scheme of things.

It is sometimes said that if we close our eyes at a concert we can sense and separate these different sounds and their sources, no matter how mixed when they reach us. In practice such judgement probably still needs to be aided by memory because of the intermingling of the direct and indirect (reflected) sounds. But we certainly can use directional hearing to help

analyse sound, and to concentrate on individual instruments.

Curiously enough, in this day when seemingly so much is known about the science of acoustics, the fact remains that there are fundamental gaps in our knowledge about how the ear and brain work together to give us these remarkable abilities.

The physiologist, M. Kraus, has summed this up as follows:

"The ear presents some of the most disputed problems of human physiology ... regarded purely technically the ear is of comparatively simple construction, so that one might hold the view that an accurate examination would immediately expose the purpose and function of each individual constituent part. Exactly the opposite is in fact the case — and all theories are still full of contradictions."

Two crucial phenomena are encountered in any explanation of the detailed mechanism of the inner ear: sound analysis and directional hearing. Max Wien in 1905, for example, showed that the capability of the ear in distinguishing pitch is much greater than could be accounted for by the conventional theories in which the basilar membrane is considered to act as a resonance organ.

Similarly the response, in the form of directional hearing, to tiny differentials of time suggests this must be done virtually at molecular level. It can be readily shown that the 'time delay' of a sound going round the outside of the head is a little more than one-half of one-thousandth of a second, so that in our ability to locate

AMBISONICS

While the hifi industry is trying to rationalise its operations around mono sound, conventional stereo and quadraphonic systems of one type or another, Professor Peter B. Fellgett of the University of Reading, England, is trying to get across the claimed advantages of his "Ambisonic" surround sound concept.

The sound is intercepted by a 4-element microphone similar to the Calrec developmental type CM 4000 as pictured, and recorded in a way which preserves full directional information. It is then encoded, and duly decoded at the listening situation to a degree permitted by the number of available channels; this on a mathematical rather than an arbitrary basis.



WARNING!

AN IMPORTANT NOTICE CONCERNING THE USE OF WALKIE-TALKIE TRANSCEIVERS

A number of low powered, short range radio telephone units — commonly known as walkie-talkies or handphones — have been imported and sold in Australia during the last twelve months.

Many of them are technically inferior and cannot be licensed because they do not meet the standards laid down under the Wireless Telegraphy Act and Regulations.

Many of them are designed to operate on a frequency which causes interference both to essential service communication concerned with the safety of life and property — and to the reception of normal radio and television broadcasting.

The use of such unlicensed (or unlicensable) sets is in contravention of the Wireless Telegraphy Act. The penalty for using radio equipment for the transmission and reception of messages without a licence is imprisonment for six months, or a fine of up to \$100.

People contemplating purchase of radio telephone units should first check with the Regulatory & Licensing Section of the Post Office to ascertain whether licences would be granted to use the units for the purpose they have in mind.

Importers: Please note that only radio telephone units which meet Australian Post Office approval may be licensed in this country. Claims by overseas manufacturers that licences are not necessary should be disregarded.

Embarrassment to importers, retailers and purchasers will be avoided if licensing eligibility is ascertained before import orders are placed. Such information may be obtained from the Superintendent, Regulatory & Licensing at Post Office headquarters in any state.

THE PENALTY FOR UNLICENSED USE IS 6 MONTHS IMPRISONMENT OR A FINE OF UP TO

\$100

AUSTRALIAN POST OFFICE

sources we are, in effect, working in millionths of a second.

It would seem that the ears work basically on starts and stops — the musician's *attack* — but we would only fooling ourselves if we suggested that we understand at all precisely how directional hearing really works and just what goes on between our two ears.

There is, for example, the curious 'precedence' effect which means that if a particular sound initially comes from a particular direction, but is then transferred to a loudspeaker in a different direction, it will appear to continue to come from the original source.

But this lack of precise knowledge has not prevented a great deal of experimental work from being carried out to try and pin-point the factors which determine how we localize sounds and how best the illusion of solid sound can be re-created.

It appears that people with normal hearing locate position in azimuth by a combination of effects: mainly the differences in the arrival *time* at lower frequencies, and time and intensity at higher frequencies.

As we have seen, the differences in arrival times, when compared with normal human reaction times, are incredibly small: these tiny fractions of a millisecond are probably on a par with the ability of a bat to fly accurately by means of its own supersonic radar system!

Zenith localization is achieved, it seems, by tiny head movements giving a rapid series of results from which the brain derives the answer. Judgment of distance is achieved by loudness and memory in places where there is no reverberation, but in enclosed spaces more by the relationship between the direct and indirect sound.

The ears and the brain seem to possess a truly remarkable (but foolable) ability to correlate the sounds reaching each ear and to separate wanted from unwanted sound.

All present stereo systems aim at providing the brain of the listener with additional information from which can be recreated an illusion of the direction of the source.

One way in which a stereo system could be engineered would be to have a large number of microphones spread evenly throughout the source of the sound — that is the performing area — each connected by a separate and carefully balanced electronic circuit to an equal number of loudspeakers similarly deployed relative to the listening area. This would not only be uneconomical but would also be impractical for broadcasting.

Instead one aims at providing reasonably accurate azimuth localization with far fewer channels. Two, three and four channels have all been used, although at present broadcast stereo is based on two channels since it is possible to combine these fairly readily on just one radio transmission.

There is certainly nothing new about the idea of providing directional informa-

AM FM/STEREO RADIO, PLUS 4-CHANNEL SOUND



Notable in a complete range of de-luxe music centres is this Technics model SS-7700, which can be bought complete with its own mobile rack, or simply dispersed on and under existing fixed shelves. It has in-built AM and FM/stereo radio, plus facilities for playing all types of stereo and quadraphonic discs, including CD-4 discrete. (Haco Distributing Agencies Pty Ltd, 57 Anzac Pde, Kensington, NSW 2033.)

tion over a limited number of channels. As long ago as 1881 two microphones were installed at the Paris Opera House and connected by telephone wires to subscribers who listened on pairs of earphones. The circuits were kept separate, with one microphone connected to each earpiece. Subscribers claimed there was little difficulty in following the movement of the singers on the stage.

Earphones remain a good method of readily achieving good stereo effects (although if you turn your head the orchestra moves too!). Indeed some recent techniques, involving the use of 'dummy heads', depend for their full effect on listening with earphones.

With loudspeakers there is the complication that each ear hears sound from *both* loudspeakers so that the positioning information becomes blurred to some extent.

One of the first practical developments was of three-channel systems for cinemas. For domestic use we have been restricted until recently to two channels, although four-channel quadraphonic systems have now come into use for tape and disc records and may influence broadcasting in the future.

The development of practical two-channel systems owes a lot to the work carried out some 45 years ago by a brilliant young engineer called Alan Dower Blumlein, who only a few years later was a leading member of the team that developed the British 405-line television system.

Blumlein even made a few stereo disc

recordings in 1929 to 1931, essentially the same as those produced today. But this was early days in electrical recording and the stereo pick-ups he developed and the recording materials and methods were not good enough for the system to be offered to the public.

In 1931 Blumlein, on behalf of EMI, filed his historic stereo patent application, and in 22 pages listed 70 claims. But this was destined to lapse before any commercial use was made of his work.

Tragically, Blumlein — the father of modern stereo — was killed in a Halifax bomber on 7th June, 1942 after a test flight for the H2S airborne radar system. In his 17 working years, until his death at the age of 38, no less than 132 patents were granted to him solely or in collaboration with other engineers: an average of one patent every 46 days.

One of the first commercial applications of his ideas was in 1955 when EMI issued some 'Stereosonic' tape recordings. In 1958 stereo disc records began to be released.

These domestic stereo systems have some important practical limitations which must be recognised if full benefit is to be obtained. For example, the two loudspeakers normally need to be placed some feet apart, and a listener only hears the correct stereo effect when sitting roughly an equal distance from the two speakers, and with an unobstructed view of them.

In general the listener seeks to set a symmetrical 'sound stage' about a central

moving up to a stereo tape deck?



SC-636



SC-737

The Sansui Models SC-737 and SC-366 are cassette decks, *not* reel to reel machines. But we understand why some music lovers are confused. Reading the specifications of the Sansui decks is like reading the specifications of a fine professional reel to reel recorder.

For example, the frequency response of the Sansui SC-737 is a surprising 30-16,000 Hz overall using chromium tape, the variation between 35-14,000 Hz being only 3 dB. The figures for the lower priced Sansui SC-636 are similar, the variation being only 3 dB between 35-13,000 Hz. Truly rare performance figures for cassette decks!

How does Sansui achieve these results? *The answer is simple.*

- Use of 4 pole hysteresis synchronous motors, so speed remains constant when power supply varies.
- Microscopic precision in the setting of Sansui's long lasting Magni-Crystal ferrite heads — which provides audibly superior high frequency performance.
- Newly developed tape transport systems, finely machined and assembled with painstaking care — the treatment usually reserved for professional tape recorders. Wow and flutter is less than 0.12% WRMS for both Sansui models.
- Built-in Dolby* B Noise Reduction Circuitry for quiet recording and playback.

There's lots more to tell about both Sansui cassette decks — features such as centre channel microphone mixing, photo-electric shut-off, etc. Your friendly hi-fi specialist store will be pleased to fill the gaps — to provide you with detailed technical data on the SC-737 and SC-636. The data and graphs tell the story — your ears will tell the difference!

*Dolby is a registered trade mark of Dolby Laboratories.

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RIA-SCD2-375

STEREO SOUND, STEREO BROADCASTING

listening area, preferably with the speakers up to 10 ft apart, equally spaced with respect to the side walls.

Reproduction can be coloured by excessive reflections from walls and floors. Ideally the speakers should be raised from the floor and spaced a little away from the walls, if possible with heavy curtaining between the walls and the speakers and with carpeting on the floor.

This need for care in installing and using equipment applies to both stereo disc and tape records and to stereo broadcasts. But of course not all living rooms can be replanned for stereo.

Sometimes it is easier to obtain good results by listening on modern stereo earphones. Listening in this way retains the sense of spaciousness and the directional effects although there are some peculiarities. The whole sound environment will turn if the listener turns his head: and he has the feeling of being in the centre of the sound source area rather than having a sound stage set out in front of him.

It was not long after the coming of stereo discs and tapes that ideas began to emerge on what had long been an ambition of some broadcasters: two-channel stereo broadcast from a single transmitter.

Here there is the basic problem of 'compatibility' with the need to provide a suitable signal for the listener who is not equipped for stereo. If you keep the two channels completely separate, the underprivileged listener would have to choose between listening either to the 'right-hand' or the 'left-hand' channel. Neither would give him the same balance that he would expect from a conventional monophonic broadcast.

But there is a very simple mathematical manipulation that overcomes this. Call one channel 'A', the other 'B', add the two together and you have $A+B$. Subtract one signal from the other and you have $A-B$ (a 'difference' signal). Make $A+B$ the prime transmission: this is what a non-stereo listener wants — he gets his balanced signal from *both* microphones. But provide the stereo listener (by ingenious electronics) with an $A+B$ signal and an $A-B$ signal.

Now if he again adds these two together he has $(A+B) + (A-B)$ which is just $2A$ (i.e. the signal from the *righthand* microphone). If he subtracts them he has $(A+B) - (A-B)$, which you'll remember equals $A+B - A+B$ or just $2B$, a signal made up entirely from the *lefthand* microphone. And the same technique is used for recordings.

So fine. Now the listener has an A signal and a B signal, and can have his stereo, while his less fortunate friends can still enjoy their $A+B$ signal coming from the same transmitter.

So in the late fifties engineers all over the world were busy developing ingenious ways in which both the 'sum' and 'dif-

ference' signals of two-channel stereo would be sent out from a single transmitter.

In the United States in 1961 the Federal Communications Commission brought together half-a-dozen different systems for field trials to try and determine which was the most effective.

In the end they chose two systems, one developed by General Electric, the other by Zenith, and told the two firms to get together and use bits of each in the final system. And so was born what is called the 'pilot-tone' system. The techniques, fascinating though they are to an engineer, tend to be so much jargon to anyone else who wants the music, not a science lesson in 'double-sideband, suppressed-carrier'.

In August 1962, the BBC began experimental transmissions with the pilot-tone system but remained, for a variety of reasons, reluctant to commit itself to a regular service. Indeed during 1964 I remember writing articles under such headlines as 'Why the go-slow on stereo broadcasting?' For already, by then, in many countries the VHF stations were beginning to make large-scale use of stereo.

Eventually a steadily increasing amount of stereo was provided on Radio 3 although for some years this was confined to selected programmes and was available only in the London area.

Broadcast stereo, like the tape and disc recordings, requires the use of dual channel amplifiers and two loudspeakers. It also needs a special decoder that separates out the various signals and feeds them in suitable form to the amplifiers.

But there are some points which need

to be known in order to receive the broadcasts properly. In radio you seldom get something for nothing — and that's true of stereo.

To put out the extra information you need more modulating frequencies and that means spreading the power of the transmitter a little more thinly. So you lose a little of your service area. Also the extra "broadness" makes the transmission more susceptible to interference from other stations. And you can't use this system for medium-wave broadcasting where there's not really enough room for one channel, let alone two.

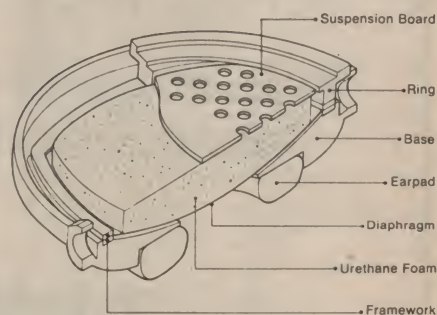
Then again a stereo receiver, if it is to take in this extra information without adding a lot of background hiss, needs a good deal stronger minimum signal than for mono listening. This often means using a lot better aerial. It is no use trying to make do with an odd piece of wire: often stereo needs an outdoor or loft aerial with two or more elements, properly installed.

And even with this there are bound to be some houses, distant from the transmitter, where you can listen quite well on mono but cannot get rid of the hiss on stereo — some people just cannot have an enormous multi-element aerial on their roofs! If you get 'hiss' on stereo but not on mono FM it's ten-to-one you are not providing your tuner with a strong enough signal.

But generally in most of the area specified for an ILR VHF station it should be possible to get good stereo with a quite modest aerial. Apart perhaps, from one other difficulty that can occur. This is when you want stereo from a relatively low-power local radio station and there's a thumpingly strong signal from a nearby high-power transmitter, whether FM or TV. With some receivers that can be a real problem.

New look piezo-electric headphones

Pioneer's new stereo headphones type SE-700 operate on a principle which is relatively unique in the field. The diaphragm of "ultra thin aluminium coated high polymer film" expands and



contracts with the applied audio voltage. Pressed against the foam pad, it becomes more or less convex with the applied signal, thereby creating sound waves which are communicated to the ear. This new adaption of the piezo-electric principle produces a diaphragm action somewhat similar to that in electrostatic headphones but, because the impedance is low, they can be driven directly from the usual headphone outlet.

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The new S.A.E. Mark III CM
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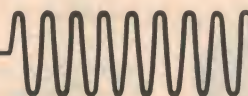


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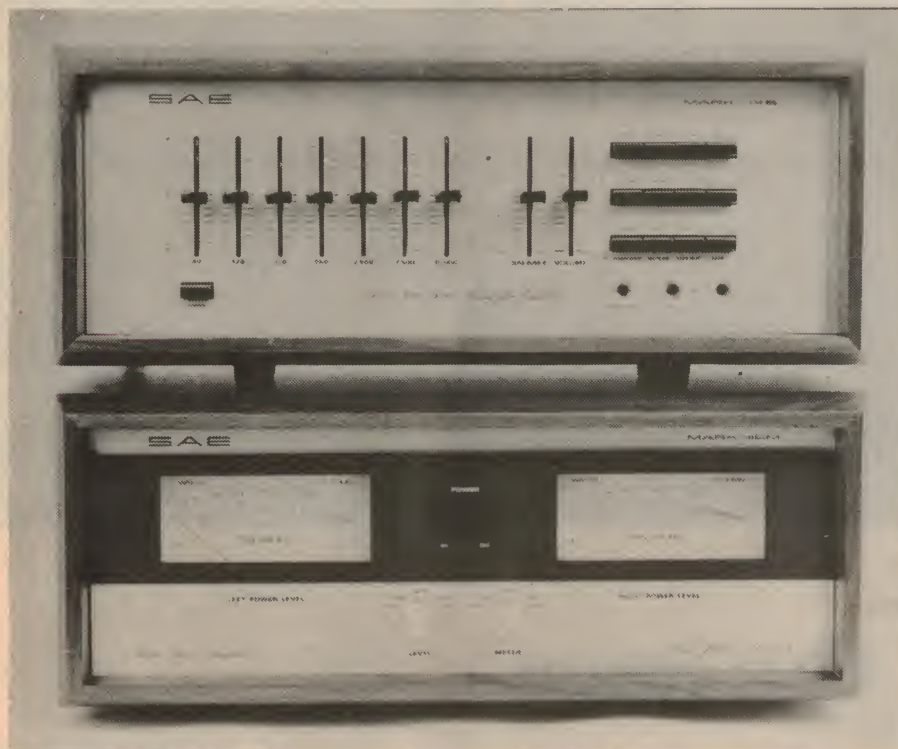
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SAE Mk IXB stereo equaliser and Mk IIICM power amplifier

Scientific Audio Electronics, Incorporated manufacture a range of high-performance equipment. Here we review one combination from their range, the Mark IXB Stereo Preamplifier Equaliser and Mark IIICM Stereo Power Amplifier.



Back in June 1974 we reviewed the SAE Mk IB stereo preamplifier equaliser and Mk IVCN stereo power amplifier. Here we review a more powerful amplifier, the IIICM and a less expensive preamplifier equaliser with less comprehensive facilities, the IXB.

Some readers may feel that the Mk IB should logically be teamed with the Mk IIICM, but the combination tested is equally viable. In any case some users may require more power but less control features.

Control layout on the Mk IXB is clean and simple, with nine slider controls and three banks of four push-buttons. The top bank of push-buttons provides input selection, with a choice of two magnetic cartridges, a tuner and auxiliary source.

The second bank of buttons functions as a mode selector with a choice of stereo,

stereo reverse, Mono A + B, Mono A or Mono B. The lowest bank has buttons to defeat the equaliser, change the equaliser range from plus or minus 16dB to plus or minus 8dB, and to select replay from one of two tape decks.

Equaliser bands are centred on 40, 120, 320, 960, 2.5k, 7.5k and 15kHz, the same as on the Mk IB equaliser preamplifier reviewed earlier. In fact, the actual circuitry of the two equaliser preamplifiers is very similar.

6.5mm jack sockets are provided on the front panel for connection of a pair of low impedance stereo headphones and a tape deck. A solitary push-button on the left-hand side of the panel turns on the power.

Thus the Mk IXB has a fairly comprehensive range of facilities. What it lacks by comparison with its more expensive

stablemate, the Mk IB, is the ability to switch the power amplifier output between pairs of loudspeakers, the facility for dubbing between two tape decks, and a greater range of gain control.

On the rear panel of the Mk IXB is the usual array of phone sockets for inputs and outputs. The unit is fitted with a two-core mains flex and is earthed via the signal leads to the power amplifier.

Inside, the Mk IXB is neatly laid out on three large PC boards. The power transformer is a toroidal unit for small size and low flux leakage. It is mounted vertically — as opposed to the horizontal mounting plane of the ferroxcube filter inductors. This keeps hum to a minimum.

While our photograph shows the preamplifier equaliser mounted on top of the power amplifier this is not a practical proposition because of hum radiated from the large power transformers of the amplifier. However the amplifier and preamplifier may be mounted close together on the same shelf with no resultant hum problems.

Both the Mk IXB preamplifier-equaliser and Mk IIICM power amplifier are supplied with attractive oiled walnut cases at no extra cost. The case of the power amplifier does not enclose the massive heatsink, so that air can circulate freely.

Massive is the appropriate word to describe the SAE Mk IIICM power amplifier, which has a weight of 27kg. Any potential user will have to provide a suitably braced shelf to mount it.

Major reason for the weight is the two large power transformers, which have their secondaries connected together to feed the common bridge rectifier and two large filter capacitors. These are 10,000uF each at 80 volts rating. The supply rails are plus and minus 75 volts DC. This is a different approach from some other high-power amplifiers we have seen which use completely separate power supplies for each channel.

Note that we do not necessarily regard amplifiers having separate power supplies as inherently superior to those having only one.

In some of their sales literature, SAE contend that their use of two transformers is more efficient than just using one large transformer. We suspect that there are several reasons for using two smaller transformers, and they have nothing to do

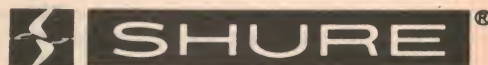


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HIFI REVIEWS

with obtaining slightly higher efficiency: It is generally cheaper (in terms of labour) to make two smaller transformers than a very large unit; they probably get a bulk discount for buying one standard transformer and it is easier to stop lamination rattle in a small transformer. It also makes for a lower profile chassis.

Other dubious statements in the same literature concern the thermal cut-out temperature, the design and operation of the large fabricated heatsink and the advantages of having six output transistors per channel. For example, the thermal cut-out temperature was supposedly set at 70 degrees Celsius because "Extensive life-testing has determined that 70 degrees Celsius is the highest allowable operating temperature for an amplifier". In fact, 70 degrees Celsius is the temperature above which many components, particularly resistors, have to be derated. But there is no practical reason why the amplifier could not have been designed to have the thermal cut-out operate at 100 degrees Celsius, apart from sheer economics and the risk of burns to the user.

We have no particular objection to any design feature of the SAE amplifier. In fact we have high regard for these products. However we do object to sales literature which attempts to claim virtues for design or economic necessity. If a manufacturer finds he can make an equally effective product by using a cheaper method, then he has an obligation to use that method and pass on some of the savings to the buyer. There is no need to attempt to justify economic efficiency, in this sort of situation.

Two large meters are provided on the front panel of the amplifier. These are calibrated in watts and in decibels. In contrast with the Mk IVCm we reviewed in June last year, the Mk IIICm has adequate illumination of the meters. Leroya Industries Pty Ltd, the Australian distributors for SAE equipment, inform us that the illumination of the meters on all models has been improved since our review.

Other features of the amplifier front panel are the touch-buttons for switching on the power and the five-position rotary switches for gain control and meter sensitivity. The gain control switch changes the gain in 3dB steps by switching resistors in the negative feedback loop.

When the amplifier is switched on the meters are immediately illuminated but there is a short time delay before a relay connects the loudspeaker. This relay protects the loudspeakers against any turn-on or turn-off transients, as well as disconnecting them in the event of damage to the amplifier, severe overdrive or excessive supersonic signal level. The thermal cut-out which monitors the heatsink temperature also acts to disconnect the loudspeakers via the relay.

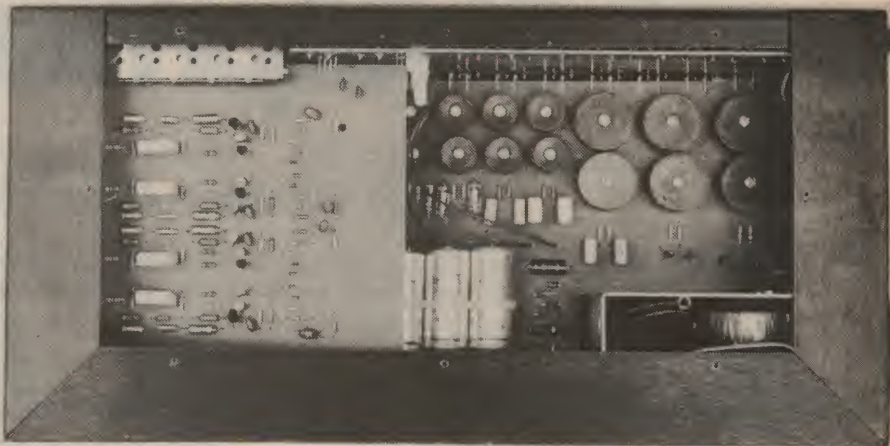
In addition, the Mk IIICm has a volt-amp monitoring electronic protection system which prevents damage due to short circuits or very low impedance loads. In fact, we were unable to disconcert the amplifier in any way by overloading or overdriving it.

Since an amplifier of this calibre is likely to be used under stringent conditions, we decided to test it under the condition whereby it dissipates maximum power — this condition is obtained by

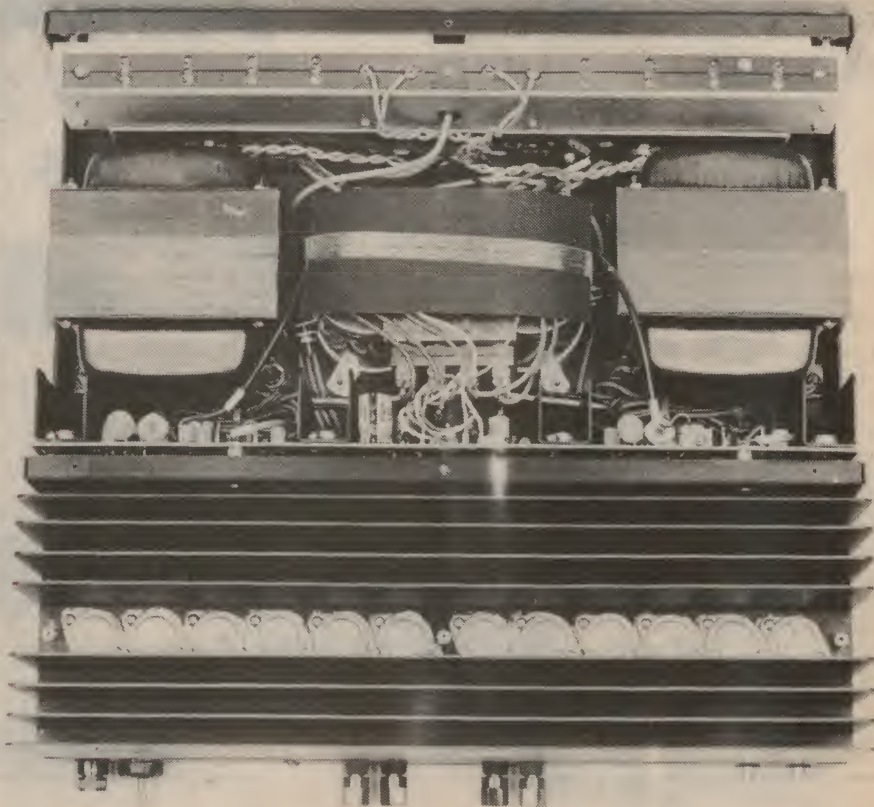
driving it to 40% of its maximum power capability, for a given load. This corresponded to almost 90 watts into 8-ohm loads.

When delivering 90 watts from both channels, the amplifier rapidly became very hot and after about ten minutes the thermal cut-out operated. At this point, the case temperature of the output transistors was approximately 75 degrees Celsius. Room temperature was about 20 degrees Celsius. After about 15 minutes, when the transistor case temperatures were down to 45 degrees Celsius, the thermal cut-out de-activated to allow normal

(continued overleaf)



Above is an internal view of the Mk IXB stereo preamplifier equaliser.



This view shows the IIICm amplifier with covers removed to show output transistors and internal details. Count the power transistors—twelve of them!

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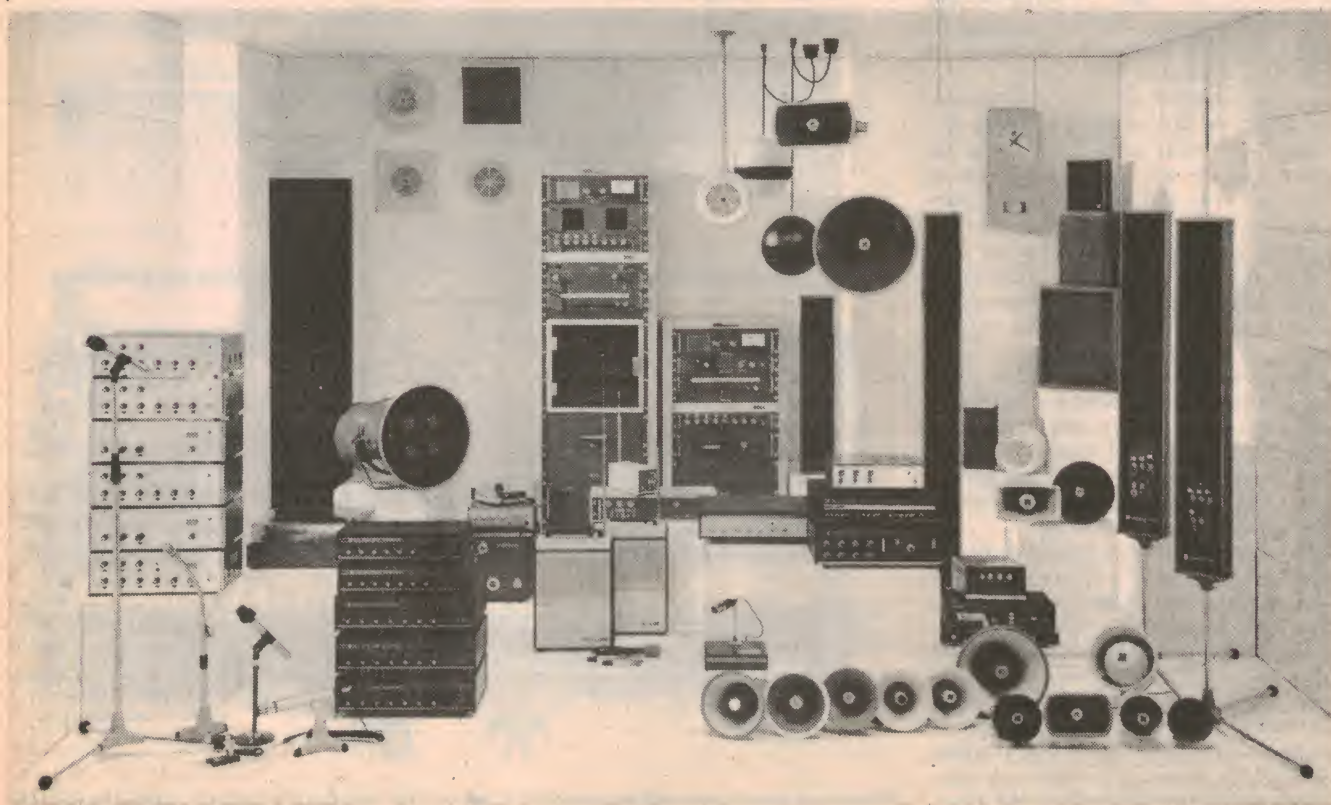
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Stanton 681EEE stereo cartridge

The latest version of the Stanton 681 stereo magnetic cartridge, the 681EEE, is now available in Australia. Termed a "calibration standard" by the manufacturer, each cartridge is supplied with its own test results.

In keeping with its status as a top-of-the-line cartridge, the Stanton comes in an oiled timber presentation case which contains, besides the cartridge, a miniature knurled screw-driver, a small metal case for spare styli, instructions and mounting hardware.

Personally, I do not know what I would do with the box after I had installed the cartridge, and I would prefer something less sumptuous in the way of packing with a consequent reduction in price. I suspect others would feel this way also.

An interesting feature of the cartridge is a "longhair" brush which travels in front of the stylus and prevents it from becoming clogged with lint and dust. The brush also acts to a certain extent as an anti-skating device and consequently, when it is used in arms with anti-skating correction, the compensation must be altered slightly to achieve the optimum results with the cartridge.

A force of one gram is exerted on the record surface by the brush and this must be subtracted from the tracking force setting of the arm to obtain the correct stylus

tracking force. Recommended stylus tracking force lies in the range from 1/4



to 1 1/2 grams.

Output connections of the cartridge have the standard EIA colour code and the mounting centres are 12.7 mm. Ellip-

tical stylus dimensions are 0.2 x 0.7 mil (thousandth of an inch).

The calibration data supplied with our sample 681EEE showed that it had a frequency response flat within plus or minus 1/2dB from 10Hz to 12kHz; within plus or minus 1dB up to 17kHz, and within plus or minus 1 1/2dB from 17kHz to 22kHz. This was for a cartridge load of 47k and cable capacitance of 275pF at a room temperature of 72 degrees Fahrenheit.

We can quote out test result more briefly: flat within plus or minus 1dB from 30Hz to 20kHz with a rise of 2dB at 20Hz. That is as flat or flatter than any other cartridge we have tested. Channel balance was within 1dB over the whole range.

Separations between channels was good at minus 28dB at 1kHz in both directions; in fact the crosstalk characteristic was a mirror image for each channel. Waveform on sine and square wave signals was very good.

Users will find that all typical records will be easily tracked by the Stanton at about 1 gram setting. We found we needed to increase it to 1 1/2 grams to enable it to track the 16dB drum test track on W & G 25/2434 and the savage 18dB lateral 300Hz tracks on CBS STR 110. All the above tests were made at this latter figure.

Sensitivity is as specified: 0.7mV/cm/sec which is typical for high performance cartridges. The 681EEE is well-shielded so noise was not a problem.

On music, the Stanton 681EEE has that clean, transparent reproduction that is only obtained with the very best of cartridges teamed with really good quality amplifiers and loudspeakers. Clearly, the 681EEE is one of the best cartridges available, regardless of price. Suggested retail price is \$90.00.

Further information on Stanton cartridges can be obtained from hifi retailers or the Australian distributors, Leroya Industries Pty Ltd, 266 Hay Street, Subiaco, WA, or interstate offices. (L.D.S.)

SAE Mk IIICM and Mk IXB

amplifier operation.

The point of all this is that the amplifier will not operate continuously at high power levels without the thermal cut-out operating to prevent excessive temperatures being produced. We understand that an optional whisper-quiet fan is available for the IIICM in the USA for continuous high-power operation. Anyone wanting the amplifier merely to reproduce normal music signals need not worry about this point. But it seems almost a waste to use this amplifier in a domestic high fidelity situation.

In case readers think we are too stringent in our tests, it is our belief that most other "super-power" amplifiers could not operate continuously at high powers (ie, above about 30% of their rated power) without fan cooling.

Checking out the ratings of the SAE

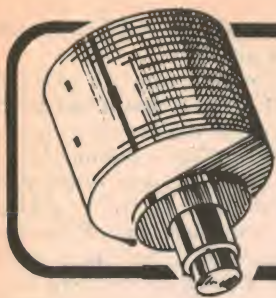
Mk IXB equaliser-preamplifier and IIICM power amplifier is almost a futile exercise since every specification was either met or exceeded. Power output is rated at 200 watts per channel into 8-ohm loads and 300 watts per channel into 4 ohm loads. We measured 220 watts per channel into 8 ohms and 320 watts per channel into 4-ohm loads. Into 16-ohm loads, power was 130 watts per channel.

Some other measurements were as follows: RIAA equalisation within 1dB; Magnetic cartridge input overload, 70mV RMS at 1kHz; Signal to noise ratio, 78dB for high level inputs, 54dB for magnetic cartridge input; Separation between channels in excess of 75dB from 100Hz to 10kHz with unused channel input short-circuit; harmonic distortion less than our measurement capability of 0.02% for all normal operating conditions.

In use, the combination is very pleasant and easy to use and is very quiet under at even very loud settings of the controls. The graphic equaliser is certainly very useful and more flexible than normal tone controls.

In short, the SAE Mk IXB stereo preamplifier equaliser and Mk IIICM stereo power amplifier form a very desirable combination, albeit far beyond the reach of all but the most well-heeled high fidelity enthusiasts. Recommended retail prices are \$485.00 for the Mk IXB and \$1079.50 for the IIICM power amplifier.

SAE equipment is available from selected retailers throughout Australia. Further information can also be obtained from the Australian distributors, Leroya Industries Pty Ltd, 266 Hay Street, Subiaco, WA or interstate offices. (L.D.S.)



News Highlights



CCD patent awarded to Bell Labs scientists

Two Bell Labs scientists, Willard S. Boyle and George E. Smith, have received a US patent for their invention of the charge coupled device (CCD).

CCDs are currently being considered for many possible uses in the Bell System, ranging from a small colour TV camera for future videotelephone systems, through time-delay and filtering circuits for telephone transmission, to memory devices for use in electronic switching systems.

The basic CCD described in the Bell Labs patent comprises three layers: one layer of metallic electrodes, one layer of silicon crystal, and a layer of silicon dioxide, sandwiched between the other two, that prohibits electrical flow between them.

As do many other miniaturized solid-state devices, the CCD employs a phenomenon found in certain crystals: their ability to permit negatively charged electrons (or positively charged "holes") to move about inside the crystal.

Most other devices use this phenomenon simply to change the electrical current that flows through them — to amplify or switch it, for example. The CCD, however, uses the phenomenon to store and transfer information in the form of discrete charge packets.

To move the packets about in the CCD, the voltages on the electrodes are used to form "potential wells", — regions within the semiconductor into which the charge packets can be placed for temporary



storage. The packets are then sequentially passed from one well to another under the influence of voltages placed on the electrodes.

The packets of charge that represent information may be introduced into the potential wells by other electronic devices, by light interacting with the silicon crystal, or by other means.

Since the invention of the CCD, Bell Labs researchers have made a number of devices, including a solid state TV camera in which a CCD is substituted for the vacuum tube of a conventional TV cam-

era. A pattern of electrical charges is created when light from an image is incident upon the device. The electrical charges, representing the optical pattern of the image, can then be read out in sequence, transmitted, and displayed on a conventional TV tube.

Bell believes that the CCD could eventually completely replace the much larger and more expensive vacuum tube camera. Resolution is currently about one half that of commercial television systems, although Bell says that a device with full resolution is possible.

Noise measurements not valid says Boeing

Giant US aircraft manufacturer Boeing Commercial Airplane Company has discovered that exact measuring of aircraft noise is just about impossible.

The finding, which follows about \$US100 million spent on noise research over the past five years, throws into question the whole concept of imposing aircraft noise standards and, in fact, certifying aircraft for use on a basis of noise.

Boeing sound engineer Vaughn Blumenthal, who spoke at a company seminar in Sydney recently, in effect also threw cold water on the extensive publicity campaign which aircraft-makers have launched on the basis of a few points difference in noise measure — effective

perceived noise decibels (EPNdB).

He said there were only about four decibel points difference between all modern aircraft and the human ear just couldn't pick the difference. Furthermore, he said, under operational conditions the noise an aircraft generates is a function of its weight at the time and the way it is flown.

Mr Blumenthal also went on to produce data to show that even carefully controlled sound tests of aircraft could be wildly inaccurate.

For instance in sideline noise of one test at Moses Lake, Washington, using identical microphones and under identical controlled conditions, there was a dif-

ference of 11 dB from one side of the test to the other. There was also a spread of 3 to 5 dB between flights. The only difference was in elevation of the ground — about 60ft over two miles.

Mr Blumenthal said although a major improvement in aircraft noise had been achieved, further quietness would be "extremely difficult and extremely expensive". One reason is that engine noise is now close to the threshold of aircraft aerodynamic noise — the sound a plane makes as it passes through the air.

This noise when the aircraft is at 300-400ft in an approach configuration — with wheels and flaps down — constitutes almost the entire aircraft sound until it is directly overhead, when engine noise takes over momentarily.

OTC/COMSAT satellite communications experiment

The Overseas Telecommunications Commission (Australia) (OTC) is currently participating in a joint experiment with the US Communications Satellite Corporation (COMSAT). The experiment, which is based at OTC's satellite earth station at Moree, NSW, and at its SEA-COM cable station in Cairns, is designed to measure the effect of rain on the polarisation of radio waves. It was prompted by the fact that the limited band of radio frequencies (in the UHF spectrum) allocated for satellite communications is becoming increasingly crowded.

One of the avenues being explored is a technique involving the polarisation of transmitted and received signals. Radio waves can be polarised in much the same way as light. Signals transmitted at the same frequency but at opposite polarisations can be detected and separated out by a receiver.

Under normal circumstances, this technique would allow frequencies to be used twice simultaneously, thereby doubling communications capacity. However, rain falling between the transmitter and receiver tends to depolarise the signals and results in jumbled reception. The OTC/COMSAT experiment is designed to measure the degree of this rain depolarisation effect.

Results from the experiment will be sent back to COMSAT in the US for study and comparison with data from a similar experiment conducted by COMSAT at its laboratories in Maryland.

Women scientists in Spacelab study

An all-woman crew of scientific experimenters recently completed a five-day exercise which may lead to the selection of similar experiments to fly on Space Shuttle/Spacelab Earth orbital missions in the 1980s. The test was conducted at NASA's Marshall Space Flight Center, Huntsville, Alabama.

The experimenters, Dr Mary H. Johnston, Ann F. Whitaker and Carolyn S. Griner, and the crew chief, Doris Chandler, spent eight hours each day of the mission in the Marshall Center's general purpose laboratory (GPL), a cylindrical structure 14 feet wide and 24 feet long. This laboratory is approximately the same size and shape of the European Spacelab currently being developed for Space Shuttle flights in the 1980s.

The purpose of the exercise, designated "CVT Test No IV", was to conduct 11 selected experiments in materials science to determine their practical application for future Spacelab missions, and to identify integration and operational problems which might occur on actual missions. One experiment is aimed at providing a basis for a standard set of support hardware for future materials science payloads.

\$15m colour TV set recall in US

... possibility of excessive radiation says BRH

The largest product recall in TV history was instituted in the United States recently when the Bureau of Radiological Health (BRH) notified the firms Panasonic, J. C. Penney, and W. T. Grant that some 300,000 colour sets marketed over the past two years must be modified to eliminate the possibility of excessive X-ray emission.

The BRH order is an outgrowth of its finding that the 9V" solid state Panasonic colour sets could be made to emit X-ray radiation in excess of the maximum 0.5MRh through the face plate if a voltage hold-down device malfunctions. Panasonic agreed to recall some 15,000 sets from the field and submitted data to BRH to show that malfunctions could not occur in other models.

However, in a letter received by the companies involved last December, BRH denied all requests for exemption, stating

that the data submitted by Panasonic failed to prove that the maximum legal limit of radiation could not be exceeded. Furthermore, BRH gave the companies 14 days to prepare to notify consumers, and ordered them to submit a plan for the modification of all sets in the field within 30 days.

It's understood that the modifications involved require the addition of several components to make the voltage limiter fail safe. Outside sources say that the cost of the recall, allowing for administrative expenses, could be in the region of \$30-\$50 per set, giving the modification program a staggering \$9-\$15 million price tag. However, a Panasonic spokesman reaffirmed the view that, outside the lab, none of the sets would suffer X-ray producing component failures, and said that the company hoped to develop a more positive proof of this to head off the recall.

Sixth Intelsat IV now in orbit

Another Intelsat IV communications satellite — the sixth of the series, and the second to be placed over the Pacific — has been launched from Cape Canaveral, Florida.

The satellite, designed and built by Hughes Aircraft Company of California, was launched by the US National Aeronautics and Space Administration (NASA) for the International Telecommunications Satellite Organisation. An Atlas Centaur booster was used to place the satellite in synchronous orbit 35,300km above the equator, and one degree from the International dateline.

The new Intelsat IV will provide added capacity and back-up assurance for the primary Pacific satellite, launched in January 1972. It will become part of a "necklace" of Intelsat IVs orbiting the globe. Three of these are over the Atlantic Ocean, whilst another is over the Indian



Ocean. The new satellite has a capacity of 6,000 voice circuits, or 12 simultaneous colour television channels.

—George E. Toles.

British companies win satellite contract

The European Space Research Organisation (ESRO) has awarded full development contracts to the value of £20 million to two British companies, Hawker Siddeley Dynamics and Marconi Space and Defence Systems, for the new maritime communications satellite (MAROTS). Prime contractor for the spacecraft under a £9 million contract will be Hawker Siddeley. Marconi will be responsible for the design and development of the communications.

The MAROTS satellite will provide ship-to-shore communications links

greatly improved on the present highly congested conventional high frequency radio circuits. It will use the basic structure and control system of the Orbital Test Satellite being developed by the MESH consortium led by Hawker Siddeley and including Engins Matra (France), ERNO (West Germany), Saab-Scania (Sweden) and Aeritalia (Italy).

MAROTS will be launched into geostationary orbit some 23,000 miles (37,000 km) above the Atlantic in 1977 and will have a minimum three-year life span. The new satellite will enable merchant ships in the Atlantic and Western Indian Oceans to establish contact with the shore almost instantaneously.

KENWOOD'S FM. CLEARLY DIFFERENT.

The hardest thing about buying an FM receiver right now is that you mightn't be able to listen to it properly.

Although FM broadcasts have officially commenced in Australia, they are irregular and weak. Many places get poor reception.

In spite of all this, FM still is the broadcast medium of the future. Australians will soon be listening to stereo transmissions, and probably 4 channel sometime later.

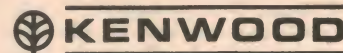
Kenwood have a name as manufacturers of fine high-fidelity equipment. They've earned it, and they deserve it. Their AM/FM tuners and

tuner/amplifiers enhance this reputation. They give clear, crisp reception of both broadcast sources.

Kenwood make receivers for all pockets. FM tuners start at under \$200. The sound is very good. And the expensive tuner/amplifiers are only expensive until you hear them. Then they become great value.

There are a lot of things we can tell you about the Kenwood tuners and tuner/amplifiers. But your ears can tell you much more. Only then will the Kenwood difference become clear.

Ask to see the full range of Kenwood Hi-Fi equipment at your nearest Hi-Fi Dealer.



TUNER KT-1300G For AM/FM radio reception. Sensitivity—AM 20 μ v, FM 3 μ v. Push-button switches for MPX, noise filter, mode—mono, stereo, AM, FM.

Recommended Retail Price
\$199

TUNER/AMPLIFIER KR-2400 Stereo. AM/FM radio reception. Sensitivity—AM 25 μ v, FM 2.5 μ v. Amplifier—16 x 2 W (RMS into 8 Ω at 1000 Hz). High and low filters. FM muting and loudness controls.

Recommended Retail Price
\$319

TUNER/AMPLIFIER KR-9340 4 channel. AM/FM radio reception. Sensitivity—AM 25 μ v, FM 1.8 μ v. Amplifier—40 x 4 W (RMS into 8 Ω 20 Hz-20 kHz). Controls for AM, FM, phono 1 & 2, CD4, aux, mono, 2CH, RM, SQ, Discrete. High and low filters, muting and loudness controls.

Recommended Retail Price
\$949

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NEWS HIGHLIGHTS

Computerised supermarket check-out

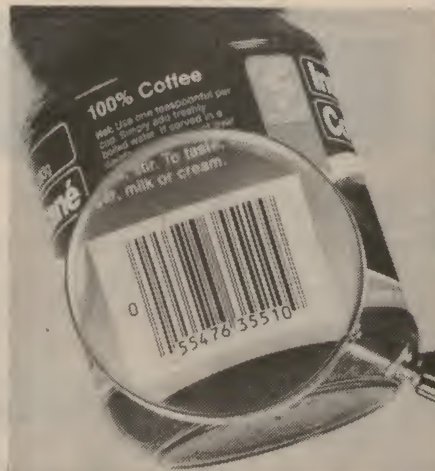
The first Canadian store test of an electronic scanning supermarket checkout system, developed by International Business Machines, has been launched by Steinberg's Ltd of Montreal. Two check-outs in a Steinberg's store in Dorval, Quebec, have gone into operation with the IBM equipment and Douglas Stewart, Steinberg's project manager, says customer acceptance has been most encouraging.

The units "read" price information printed in a linear bar code, and record the price and product description on the register slip in both English and French. The scanner is fixed, unlike the electronic pencil or wand used in some systems.

Because only two of the 12 checkouts in the store use the IBM system, long lines have been forming at the automated desks as customers try them out. Store traffic and volume is higher since the test began, and Mr Stewart says large numbers of small purchases are made by people curious about the system.

The test is the second to date for an optical scanning system in a North American supermarket. NCR Corporation of Dayton, Ohio, has its system on test in one store in Troy, Ohio.

About 10 percent of store items have Universal Product Code (UPC) information on them when received. During the early stages of the test period, shelf items will be marked with the normal price tag and either the UPC information provided by the manufacturer or a UPC price tag.



The Universal Product Code (UPC), shown above, is the key to computerised checkout systems, and will eventually replace conventional price markings on most items.

Mr Stewart sees several advantages for the system, including savings in costs by eliminating price tagging when UPC information is more widely adopted by manufacturers.

The system is also expected to move customers through the checkouts faster and improve checkout accuracy by eliminating reading and punching errors. In addition, it will provide more accurate and detailed management information than existing checkout systems.

—George E. Toles.

New digital watch has seconds readout

Recently released onto the Australian market by Deltatron Microsystems Corporation, Carson, California, is a new digital watch featuring a liquid crystal display and a unique seconds readout.

Designated the "Delta", the new watch is fully solid state and has no moving parts. It is timed by a 32,768Hz quartz crystal oscillator operating in conjunction with a single CMOS integrated circuit which performs the required frequency divisions. Accuracy is claimed by the manufacturer to be plus or minus 5 seconds a month.

The liquid crystal display provides good readability in all light conditions, including direct sunshine, whilst minimising current consumption. The unit is powered by a miniature silver oxide battery which has a life expectancy of one year.

Setting the watch to the correct time is accomplished by simply activating two of the three external buttons. These allow the time to be set to the nearest second. The third button is used for displaying



the seconds mode. When this button is depressed, the hours and minutes are cleared, so that only the seconds are displayed. Depressing the button again returns the display to the hours and minutes mode.

Deltatron Microsystems is represented exclusively in Australia by Landshire Industries, Park Regis, Suite 272, 27 Park Street, Sydney, NSW 2000. Telephone: 61 4519.

Pipeline communications contract to AWA

AWA Engineering Products Division has been awarded a contract worth approximately \$500,000, to provide a VHF vehicle communications system for the Moomba to Sydney natural gas pipeline project.

The AWA system will form part of the \$6 million micro-wave radio communication network being provided by the Australian Post Office specifically for monitoring and controlling activities along the length of the pipeline.

Fifty base-stations between Moomba (South Australia) and Sydney, together with equipment installed in vehicles, will provide communication facilities between the pipeline operations control depots at Cobar, Young, Sydney and maintenance vehicles along the route.

Other equipment included in the AWA contract provides for communication installation in aircraft which will periodically check the pipeline from the air, and UHF link equipment for telemetry data from sites along lateral pipelines to Lithgow and Wagga Wagga.

The project is expected to be completed by December 1975.

US TV manufacturers focus on digital tuners

The current slump in television sales in the US is providing TV manufacturers with the time and impetus to examine new approaches in systems and components design. Activity is currently focussed on a device which has interested TV manufacturers for some time, and which represents a potentially vast component market — the digital TV tuner.

Several companies are currently active in the digital TV tuner field, and two alternative versions have already been developed with a view to 1976 markets. The first unit is the result of a joint development program undertaken by the British firm Plessey Semiconductors and the US firm National Semiconductor. Both Plessey and National components are used in the new digital tuner kit, Plessey supplying the UHF frequency divider circuit, and National the large-scale integrated MOS circuit.

The version now being shown to potential customers consists of 16 ICs available off the shelf, and carries a price tag of just under \$30. However, TV manufacturers have indicated that to be viable the tuners would have to retail for less than \$20.

Plessey and National have a potential competitor of note, however. Fairchild has developed its own digital TV tuner and, according to Fairchild staff engineer Eric Breeze, the new tuner is being evaluated by "many of the major TV manufacturers."

The Fairchild tuner kit consists of 33 ICs, and also retails for just under \$30.

Dick Smith Ele

Fantastic F.M. Tuner

"Very good value indeed" Neville Williams, Electronics Australia, Feb. 75

Only \$75



Don't take our word for it, see the review in Feb. E.A. The Echosound Tuner is incredible value for money. Has separate AM and FM front ends. 10 transistors and 14 diodes. Covers FM 88 to 108 MHz AFC, 60db S/N, 35 db sepn. 600mV output AM 535 to 1605kHz, ferrite rod antenna. Features multiplex adaptor complete with built-in stereo indicator. 240V operation. Complete in Walnut case. Guaranteed for 12 months. Such has been the demand that we are air-freighting them in. Don't miss out at only \$75.00 (P & P Free).

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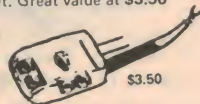
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TK700 Cube speakers handle 10W with a response that has to be heard to be believed. Has 8 ohm full range 5" speaker with 1 1/2" voice coil throw! Response from 45 to 18kHz thanks to huge 3" magnet yet measures only 6" cube. Available in red, black or white (specify). Ideal extension or 4 channel rear unit or for budget hi-fi. Only \$14.95 each (P & P freight on).

FM splitter. This one is a beauty. Splits incoming 300 ohm TV aerial lead giving outlet for FM tuner. In fact 3 outputs TV VHF, TV UHF and FM. Fits on back of TV set. Great value at \$3.50



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up to 50 miles over water

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Freq. Stab: 0.005%

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Antenna: 13 section telescopic
Power: 8 x 1.5V UM3 cells

Size: 8 1/4 x 3 1/4 x 1 1/4"
Weight: 25 oz

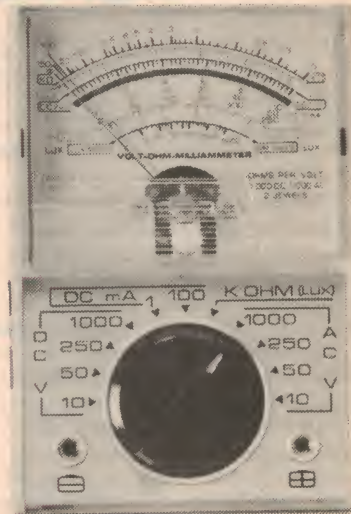
We have the Contact CT10 at the same, YES SAME price as our old catalogue. It must be the cheapest, 1 Watt, fully approved unit in Australia at ONLY \$39.95. Buy 5 or more and save \$2.00 on each unit at only \$37.95 (P & P \$2.00 per unit).



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This is a great idea. You get a basic multimeter with a scale marked in lux. Simply spend an extra \$6.00 on the special lux probe and you have a light meter measuring from 10 to 5000 lux (mid-scale 300lux). Normal ranges: Vdc 10, 50, 250, 1000; Vac 10, 50, 250, 1000; Adc 1mA, 100mA Ohms 150k. Basic instrument offers 1000 ohm/V, mirror scale, 11 ranges. Highly recommended but hurry orders for lux probe as only 50 available.



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At last an Australian PAL book PAL Colour TV for Servicemen by Cook, Wren 248p \$15.00. This is a must. Written by an Aussie, this is the best book on Aussie PAL (and N.Z. too). Assumes B & W experience and covers theory in a not too technical way. Practical approach to solid state and IC circuits. Very thorough with heaps of diagrams, many in colour. Well written by a man with 30 years experience who set up training courses here.

Projects and Circuits from Electronics Australia \$2.00. It's a beauty, all the popular tried and tested circuits from EA: Reaction timer, tape amp, bongos, microradio, train controller, tuner, novelties etc. etc. There's over 30 projects and 112 pages for only \$2.00.

COLOUR TELEVISION THEORY G. Hutson, 326 pages. This book assumes the reader to have a working knowledge of monochrome television principles. It deals almost exclusively with the PAL system, but a chapter is devoted to the NTSC system. The text begins with an easy read chapter on "light" physics to give the reader a basis on colour mixing, chromaticity diagrams etc.; the principles are dealt with step by step in an easy to understand form. Practical circuitry and diagrams accompany the text, to give an interesting explanation. Colour plates are included to show relevant colour information. A chapter is devoted to transmission, and describes the difference between PAL, NTSC, and SECAM. In all, a complete, thoroughly absorbing easy to read text. This book is not only a must for all television technicians but of enormous interest and value to all interested in colour television. We are getting entire Australian shipment, so this book is virtually available only from us. \$12.50.

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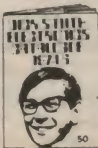
Another 600 pages of easily understood explanations of machines. Volume 1 has been a sell out. Now Volume 2 tells you about a whole lot more — how colour TV is transmitted, why is dry cleaning called dry, how does a computer compute. Ideal for the layman and anyone with inquisitive kids. Covers the simplest household gadget through to radar and jet engines. We have special stocks of both volume 1 and 2 at \$5.95 each or get the pair for \$11.50 (P & P \$1.10 per volume \$1.50 pair).

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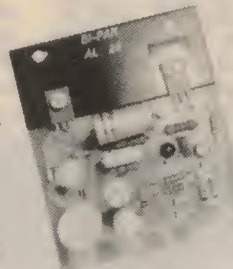
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PARAMETER	CONDITIONS	PERFORMANCE
HARMONIC DISTORTION	Po = 3 WATTS f = 1 KHz	0.25%
LOAD IMPEDANCE	—	8-16 ohm
INPUT IMPEDANCE	f 1KHz	100 kohm
FREQUENCY RESPONSE ± 3dB	Po = 2 WATTS	50Hz-25KHz
SENSITIVITY for RATED O/P	V8 = 25V. R18 f = 1KHz	75mV. R.M.S.
DIMENSIONS	—	3" X 2 1/2" X 1"

The above table relates to the AL10, AL20 and AL30 modules.

The following table outlines the differences in their working conditions.

PARAMETER	AL10	AL20	AL30
Maximum Supply Voltage	25	30	30
Power output for 2% T.H.D. (RL = 8ohm f = 1KHz)	3 watts R.M.S. Min.	5 watts R.M.S. Min.	10 watts R.M.S. Min.
NORMAL PRICE	\$13.00	\$15.00	\$16.00
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How the ABC converted to colour

The conversion of its nation-wide television broadcasting facilities to colour provided the ABC with the most complex and challenging task since its formation. This article takes a look at the goals set by the ABC before C Day this month, gives details of the overall colour conversion plan, and describes the progress made thus far.

by GREG SWAIN

In February, 1972, the Federal Government announced its decision that colour television would be introduced into Australia, commencing 1st March, 1975. The decision involved the conversion of the existing VHF system to colour using the PAL system, the system to be used having been determined at an earlier date. No plans were given for extending the television service into the UHF band.

Following the Government's decision, the ABC announced its intention to provide a substantial colour service from 1st March, 1975, from its seven capital city studio centres in Sydney, Canberra, Melbourne, Brisbane, Adelaide, Perth and Hobart. The conversion of its television facilities to colour is the largest single project undertaken by the ABC, and involved the modification or replacement (mostly the latter) of all its vision, distribution and pulse equipment, and much of the videotape and telecine equipment.

In addition, studio facilities had to be re-designed for colour production.

The ABC's overall plan for the conversion of its TV studio centres to colour is operating in two phases. Phase 1, scheduled for completion on March 1, 1975, covered those facilities necessary for initial colour operations. This work included:

- the conversion to colour of all the central apparatus facilities and a significant proportion of the telecine and videotape facilities in the main studio centres in Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart and Canberra;
- the conversion of one of the two major production studios in both Sydney and Melbourne;
- the conversion of the presentation/news studios in Sydney and Melbourne (two in Sydney and one in Melbourne);
- the conversion of one production studio each in Brisbane, Adelaide, Perth, Hobart and Canberra;

- the provision of 7 four-camera colour OB vans for Sydney (2), Melbourne, Brisbane, Adelaide, Perth and Hobart. The two vans based in Sydney also serve Canberra; and

- the provision of a colour standards converter for Sydney.

Phase 2 of the ABC's colour conversion program is to be carried out between 1975 and 1978, and covers the conversion of the remainder of the facilities in the centres listed above, and the conversion of three smaller regional centres in Darwin, Rockhampton and Townsville. The ABC's studios in Darwin emerged relatively unscathed from the recent cyclone that devastated the city, and plans for the colour conversion are, at this stage, to proceed as normal.

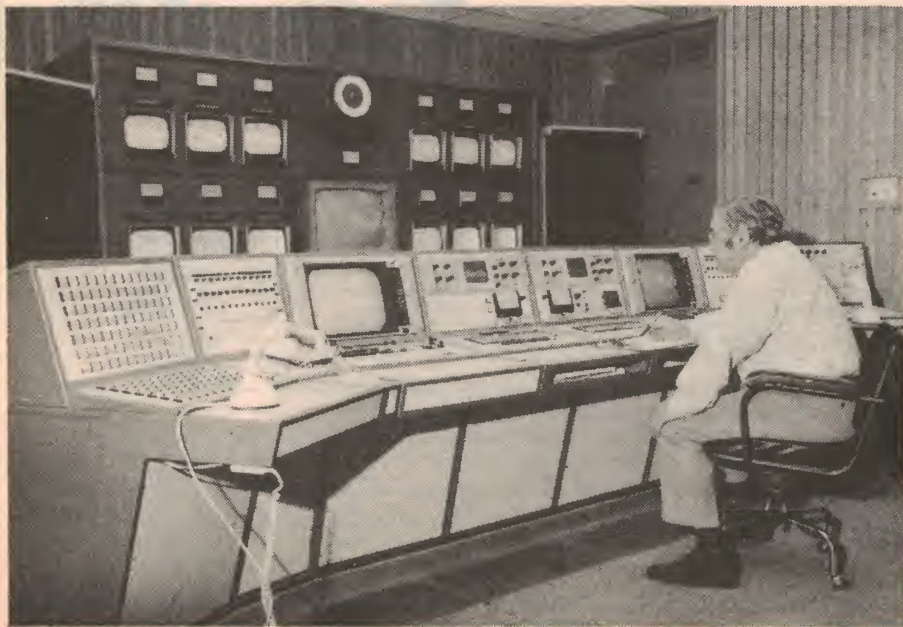
In order to avoid duplication of effort in systems design and installation planning throughout the various centres, specific projects were allocated on a state basis. This has resulted in a substantial measure of standardisation of colour installations, particularly in Brisbane, Adelaide, Perth and Hobart, and between Sydney and Melbourne.

The complete engineering installation schedule was programmed in PERT (pre-view evaluation review technique) form into a computer to provide a guide on the progress of the total conversion program on a state and federal basis. This enabled a regular check to be made on danger points in the program.

Based on 1972 figures, the cost for the colour conversion equipment alone was estimated at \$21 million. Of this, it was estimated that some \$14 million would be spent by C Day, 1st March, 1975. These costs do not include installation costs, training costs, planning and administration costs etc.

Obviously, the training of technical personnel formed an important part of the overall colour conversion program. These training courses consisted of technical courses put together by training officers, together with various maintenance courses conducted by equipment suppliers. In addition, as the conversion of each of the main facilities was completed, they were used for familiarisation training before being fully committed for operations.

Training was carried out on a rotational basis, with Sydney serving as the main training centre. Key staff from the other capital centres were progressively brought to Sydney for training and familiarisation



The master control room at the ABC's Gore Hill studios, Sydney.

courses. On their return, these personnel were engaged in the acceptance and installation of colour equipment at their various centres, and helped train other local staff. In the first instance, local training was carried out using basic sets of colour test equipment and was followed up with further practical training on colour equipment as it became available.

Conversion of the transmitters and studio-to-transmitter links to colour is the responsibility of the Australian Post Office (APO). At the time of writing, all transmitters and associated translators in Victoria, Queensland and Tasmania are now colour operational. In New South Wales, South Australia and Western Australia most of the regional transmitters as well as the capital city transmitters have been converted. Further regional transmitters will be added to the colour network as installation work proceeds.

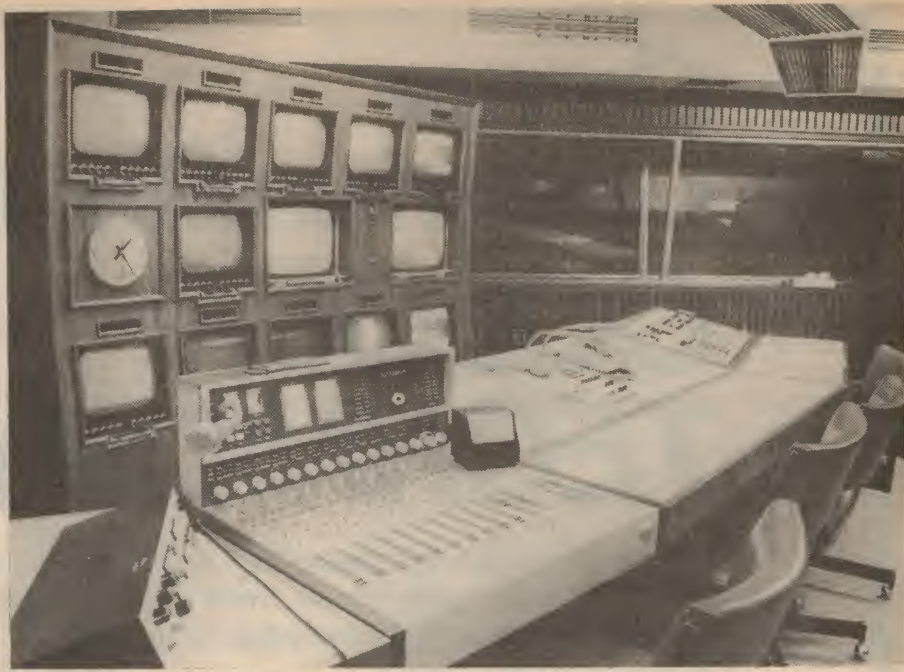
All seven OB vans ordered by the ABC have been delivered, and the last of these is expected to be commissioned by mid March 1975. These units comprise three Marconi vans, each equipped with four Mark VIII cameras; three Pye/Philips vans, each equipped with four Philips LDK5 cameras; and one Fernseh van equipped with four KCU-40B cameras. The Fernseh van will be based in Perth.

Last December, the author was privileged to tour the ABC's Gore Hill complex in Sydney to inspect the work undertaken in the colour conversion program. The task facing technical personnel has been massive, and it is probable that only a personal tour would allow one to appreciate the extent of the program. Although there have been some hold-ups, mainly due to equipment delivery delays, most of the work in progress at that time was proceeding according to schedule with every indication that the goals set for C Day would be achieved.

The two small news/presentation studios, studios 23 and 24, had already been completed, and in fact had been in operation for over 12 months. These were completed early in the conversion program to allow colour transmissions of news programs etc on a limited basis since last October. These studios were also used as the venue for colour familiarisation workshops for senior production and technical operational staff, before going into production.

Both studios at present feature two Fernseh KCU-40 cameras, although it is planned to upgrade the number of cameras to three in the near future. Studio 23 is equipped with a Datalite "100" digital memory lighting control system. A data display on a conventional monitor screen indicates the status of the lighting. Similar lighting control equipment will be installed in studio 24 in due course.

Each studio incorporates an RCA vision mixer and a Central Dynamics video switcher. A Studer sound control console is incorporated into studio 23, whilst an Astor console is used in studio 24.



These two photographs show the sound and vision mixing control rooms in Studios 23 (top) and 24 (bottom). Both studios were completed well before C day.

At the time of the author's visit in December, Studio 21 was still in the throes of conversion. However, the bulk of the work had been carried out, and engineers were confident that this studio would be in production well before C Day. The ABC's second large production studio, studio 31 in Melbourne, has been in operation since September last year.

The equipment installed in Studio 21 is impressive in anyone's language. Equipped with four Marconi Mark VIII cameras, the studio occupies some 460 square metres. The three elevated production control rooms adjoin one end of the main studio area. These are the main production control room, the sound control room, and the technical control room.

One interesting point here is that the camera control operator does not look directly into the main studio area. Instead,

camera control is effected by viewing a preview monitor. This procedure differs from that used previously in monochrome production work.

The lighting control facilities for studio 21 are also placed in the technical control room. The equipment employed is a computerised system supplied by Rank Strand (Aust), into which can be pre-programmed intensity level information for the automatic control of groups of lights. All intensity level control, processing and storage is carried out through an 8-bit code which provides 255 discrete levels between zero and full intensity for each channel.

The studio area itself is equipped with approximately 180 motor-operated battens, each 1.22 metres long. When setting the lighting pattern, the battens can be raised or lowered from any point on the studio floor using a small digital control

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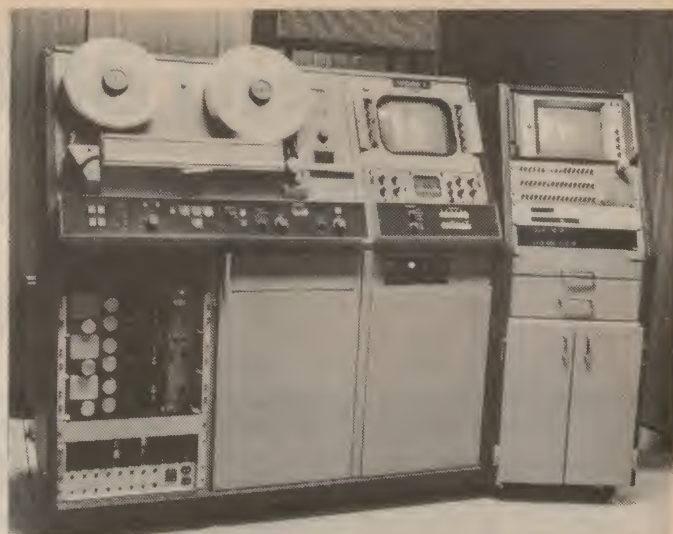
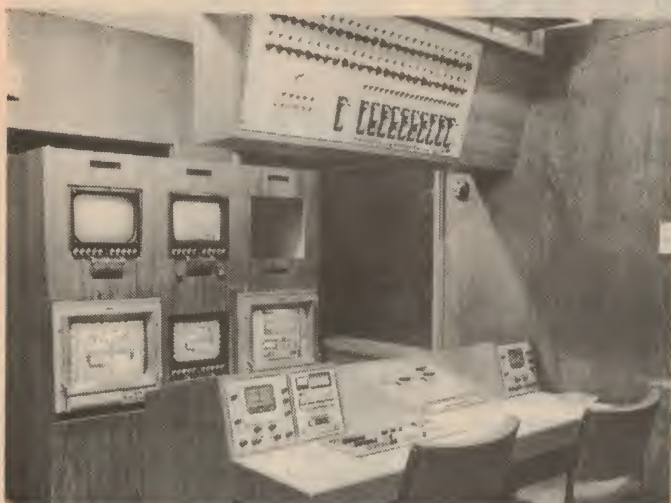
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ABC Colour Conversion



At left, remote camera control and lighting control facilities in Studio 24. Above shows Ampex colour VTR.

unit connected via a flexible lead and wall socket to the motor control mechanisms.

The main production control room is centrally located between the technical control room and the sound control room. A Grass Valley Inc video switcher with full signal monitoring capabilities is used here, together with Barco 20" monitors. Full talkback facilities have also been provided.

Sound control facilities consist of a 40-channel sound mixing console manufactured by Quad Eight, a Californian company. Designed around standard modules, this unit was custom made to ABC specifications.

The central apparatus room which controls network switching and program distribution for recording or transmission purposes has been completed and in operation for some time now. A great deal of the work here involved re-cabling to studio, telecine and videotape areas, as the original cables were inadequate for colour purposes.

Installation of the telecine and videotape equipment in Sydney is running behind schedule and will not be completed for some months to come. However, sufficient progress in this area has been made to permit a "patch" type operation until the installation of this equipment is finalised.

The equipment involved here comprises two Rank Cintel 16mm units, two Fernseh 16mm units, a Fernseh 35mm unit, a Rank Cintel slide scanner, and an EDS caption scanner. The video tape machines were designed and manufactured by Ampex, USA.

Hold-ups in this area were mainly due to the late delivery of primary and ancillary equipment. However, all studio centres in Phase I of the colour conversion program (including Sydney and other capital city areas) were due to have some colour film and videotape facilities operational well before C Day.

In company with the installation of equipment, extensive building alterations

were necessitated by the conversion program. This not only involved building alterations to studio areas, but also the construction of elevated floors so that cable runs could be accommodated on top of the old floor level. The air-conditioning equipment also had to be extensively upgraded.

To facilitate the exchange of colour television programs with broadcasting organisations in such countries as the United States, Canada and Japan, it was essential that a standards converter capable of converting 525/60 NTSC colour signals to the Australian 625/50 PAL standard be installed. The unit purchased by the ABC is the Fernseh NC56P40, which uses two interlocked electro-optical converters, each having a picture tube and a pick-up tube. One converts the luminance signal, the other the chrominance signal. Four pushbuttons provide the following combinations: NTSC/PAL, PAL/NTSC, NTSC/NTSC and PAL/PAL.

The ABC has also indicated its interest in the development of digital colour standards converters in Japan and the UK. However, suitable equipment of this type is not yet in commercial production.

Obviously, the colour conversion program has not been without its difficulties, not the least of which was the maintenance of normal monochrome transmissions whilst equipment installation and building alterations took place. As mentioned above, equipment delivery delays also caused problems, necessitating the re-distribution of some equipment to meet test transmission deadlines last October.

Taken overall though, it would appear that the major goals set by the ABC for C Day have been achieved. The stated intention of the Commission was that all programming after 6 pm each day from C Day onwards be in colour. By the time you read this we should be in a position to judge the results of their efforts over the past three years.



Studio 21 lighting and camera control room, Gore Hill, Sydney.

Rank introduces the RX400 Telecopier

Facsimile transmission networks have been successfully operated in Britain, Europe, the Soviet Union and the United States for more than two years now, and with soaring costs for postal and special messenger services, it is inevitable that such methods will find wide application in Australia. It was with interest, then, that we noted the recent introduction into Australia of the Rank Xerox RX400 Telecopier facsimile transceiver.

A compact desk-top unit, the Rank Xerox RX400 Telecopier is suitable for the transmission and reception of written, typed and graphic data over both public switched and private telephone lines. The unit has been approved by the Australian Post Office and the International Telegraphic and Telephone Consultative Committee (CCITT). This means that Australian Telecopier users will also have access to an existing network of Xerox facsimile transceivers operating in a number of countries throughout the world.

Rank Xerox executives see the Telecopier as particularly suited to Australian business communications needs. They point out that although commercial and manufacturing centres in Australia are separated by great distances, all are linked by telephone communications. Since the machine can be used on both public telephone lines and private wire circuits, the market for facsimile transmission services is limited only by the growth of demand for "instant" graphic communications capability.

Facsimile transmission offers several advantages as compared to conventional telex communications systems. First, the original document need not be transcribed for transmission, thus eliminating the possibility of error during transcription.

Errors during message transcription by the recipient are also precluded. Secondly, it is possible to transmit graphic material in its original form, a feature which is particularly important for time-vital graphic formation.

Operating principles of the RX400 Telecopier are quite straightforward. In simple terms, signal pickup is by means of a phototransistor sensor which responds to changes in the intensity of reflected light from each element of the document as it is scanned on a rotating drum. The signal output from the phototransistor is amplified and passed to a feedback control amplifier which provides further amplification and automatically adjusts the video signal to reduce document image background to white.

The output signal voltage derived from the feedback amplifier is used to control the frequency of an oscillator stage. From here, the resultant frequency modulated signal is fed to the transmit amplifier, the output level of which can be adjusted to meet the injection level requirements of postal authorities.

Output from the transmit amplifier is in the form of a square wave which is filtered so that all output frequencies are within the correct bandwidth for connection to the telephone line. The resultant

signal is coupled to the telephone line by an isolating transformer.

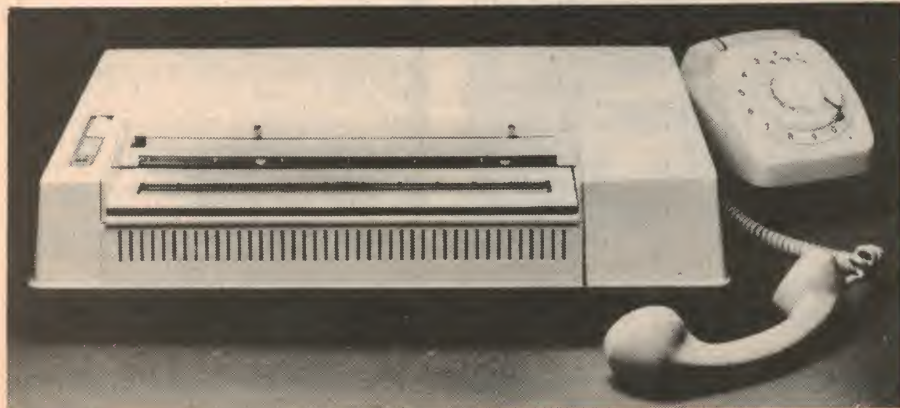
At the receiving end, the incoming signal is band-limited by a filter, after which it is amplified and limited before passing to a demodulator stage. The demodulated signal is used to control the amount of current passing through a stylus which is in contact with a special electro-resistive paper. By using identical drum speeds and scan rates in the sending and receiving units, a facsimile of the original document is produced as stylus current passes through the paper, exposing various shades of grey and black.

The image on the receive paper is reproduced in the same position as that shown on the original document. This is accomplished by positioning the drum and stylus in the receiving unit in the same position relative to each other as the drum and the scanning optics in the transmitting unit. This positioning process is called "phasing", and is accomplished during the first few seconds of each transmission. The phase relationship thereafter is maintained by the identical speeds of the drums, controlled in turn by individual crystal controlled oscillators in each unit.

The equipment itself is simple to use, and operator training is minimal. There are two main controls only, these being a send/receive selector, and a line key which is located either on the transceiver or on the associated telephone, dependent on the country of installation. Two other controls are provided, namely a selector switch for a vertical scan pitch of 96 or 64 lines per inch (3.78 and 2.52 lines per mm), and an electrical supply isolation switch. The transceiver will accept documents up to A4 size.

Overseas, the RX400 Telecopier has found a wide variety of applications in industry and in government services. For example, printers and newspaper offices in several European countries are sending and correcting proofs by Telecopier. And in Sweden, a hospital group is using a network of Telecopier transceivers for high speed reporting of pathology test results between laboratories and hospitals.

In Britain, a company which specialises in high-speed translations for businessmen has installed several Telecopier transceivers to improve "turn-around" time on complex translations and offer better service to clients. Three transceivers are in use—two in London and one in Switzerland. Banks and stockbrokers are also



The Rank Xerox RX400 Telecopier is both compact and simple to operate.



An interior view of the RX400 Telecopier. All components are readily accessible.

making use of facsimile transceivers to speed up the flow of information on international money market transactions and share price fluctuations.

Perhaps one of the most dramatic applications of the Telecopier is its use by the Swedish ice-breaker authorities. Five Swedish ice-breakers are equipped with Telecopier units for sending up-to-the-minute changes of ice patterns in the Baltic Sea.

These "ice-maps" are transmitted by Telecopier to headquarters in Stockholm. There, reports from Swedish and Finnish ice-breakers are co-ordinated and used to plot the quickest, safest and most economic routes for commercial shipping on passage through the Baltic.

Swedish authorities decided that facsimile was the answer to the previous time-consuming and error prone method of transmitting ice and weather data from ship to shore by radio telephone links. The radio telephone links are, of course still used. However, results are now printed out in graphic form rather than as a long list of latitudes and longitudes.

Rank Xerox executives responsible for marketing the Telecopier in Australia foresee a heavy demand for both inter-city and intra-city facsimile transceivers. Since the machine is capable of transmitting documents up to A4 size in four minutes, communication by Telecopier for time-

vital information makes good business sense. Even detailed drawings and plans and poor quality originals, where high resolution is required, can be transmitted in as little as six minutes. Portions of documents can be transmitted in a matter of seconds.

Obviously, facsimile transmission is faster and more secure than either mail or express courier service, and may eventually lead to a reduction in dependence on these services for time-vital document communication. Rank Xerox says it will be seeking installation of the Telecopier in a variety of business areas, particularly those where the relaying of information regarding sales orders, spare parts, artwork, etc., is now carried out by telephone, telex, mail or courier.

This article is based on information supplied by Rank Xerox (Aust.) Pty Ltd, 111 Pacific Highway, North Sydney, NSW 2060.

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Playmaster 145 Mixer

In this article on the Playmaster mono-stereo mixer we continue description of the circuitry and give details of construction. Comprehensive specifications are also featured.

by LEO SIMPSON

As stated in the first article, the main mixer board has four inputs in each channel, each with an input sensitivity of 40mV for the nominal output level of 0.775 volts RMS, and an input impedance of 10k. When combined with the 10k level control of each input, the input impedance is shunted down to a minimum of 5k.

Where a higher input impedance is required for a high level source such as a tuner, the input impedance may be simply increased by connecting a resistor in series with the input. This is done by making up a jumper board which is inserted into the mother board in place of the preamplifier board. For example, the input impedance can be increased to 20k by using a jumper board with a 15k resistor. This reduces the sensitivity to 16mV for rated output.

We will describe how to make a jumper board later, in the section on construction.

Apart from high level sources such as broadcast tuners or tape recorders, greatly increased sensitivity is required for all the low level sources the mixer is likely to be used with.

Accordingly, each input is provided with its own PC preamp board which is plugged into the mother board. The preamplifier boards use a standard copper

pattern and circuit configuration. Circuit constants are modified to give the required gain, input impedance and frequency characteristic.

Refer now to the circuit of the preamplifier which we have designated as a "universal preamplifier". Two high-gain low-noise NPN transistors are used, in a direct-coupled feedback pair configuration.

Astute readers will notice that this circuit is very similar to one following the mixer stage on the main mixer board. The voltage divider resistors in the emitter circuit of the second transistor, Tr9, have been changed (from the circuit of the mixer board) to take into account different operating conditions.

The AC feedback components are R3, C3, R4, C2, R2, C1 and the 1.5k resistor in the emitter circuit of the first transistor. The input impedance is varied by changing bias feed resistor R1.

The values for the components nominated above are tabulated below the circuit. To make each type of preamplifier, just refer to the appropriate values in the table.

For a guitar preamplifier, for example, R1 is 100k, R3 is 33k, R4 is replaced by a wire link and the others (R2, C1, C2 and C3) are omitted. The resulting

preamplifier has a gain of just over 20 and an input impedance of 100k.

Note that the input impedance of all the low level preamplifiers, except that of the magnetic cartridge preamp, is 100k. We have not attempted to "match" the input loads to the nominal impedance of the sources. So we have the apparent anomaly of a 600-ohm microphone (say) feeding a 100k input load.

There is no point in providing a low impedance load for a low impedance source. If the load impedance matches the source impedance half the signal is lost and residual noise produced by the amplifying stage reduced little, if at all. For optimum signal/noise ratio, and amplifier should be arranged to provide a nominal high impedance load and be driven by a low impedance source. At the same time, the operating conditions of the amplifier should be optimised to give the lowest possible residual noise considering the source it is to be used with. In general, this means selecting the optimum quiescent current for the first transistor in the amplifier. This has been done in the universal preamplifier circuit, after considering the variety of sources it will be used with.

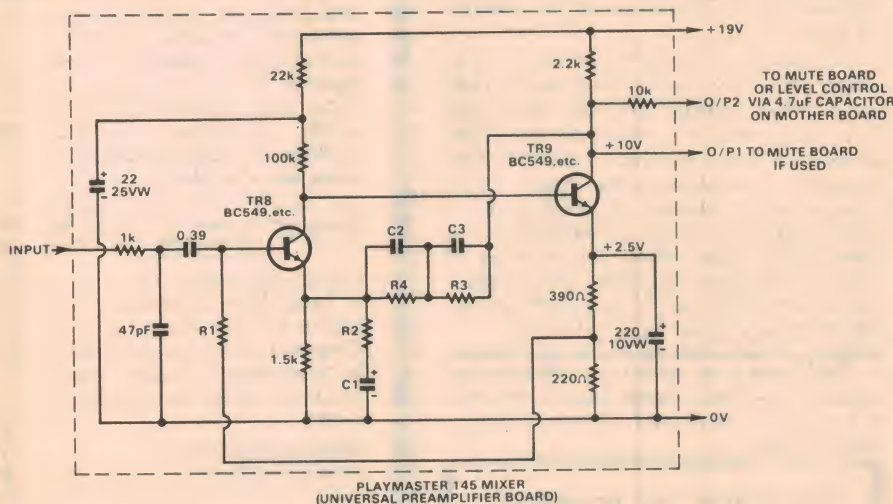
To make a corollary of the previous paragraphs: unless an audio source is required to operate into a stated load (such as 50k for a magnetic cartridge) in order to obtain its rated frequency response, the load impedance should be considerably higher than the source impedance, otherwise there will be a loss of signal and a reduction in the signal/noise ratio.

There are two preamplifier outputs, output 1 and output 2, the latter being fed via a 10k resistor. These two outputs are necessary to drive the mute board which is described later. Readers will also notice that there is no output coupling capacitor on the universal preamplifier board. This is located on the mute board or on the mother board.

Readers may wonder why the frequency response of the low impedance microphone preamplifier is better at the low end than for all the other preamplifiers. This is merely a function of the feedback network which causes a slight "hump" in the low frequency response.

Signal-to-noise ratios are quoted with respect to the rated output of 0.775V RMS and are unweighted (ie, measured with a millivoltmeter having a wideband response). Unless otherwise stated, the measurements were taken with a short-circuit input, ie, with the appropriate input jack removed which automatically shorts the input. In each case, connecting a typical input source causes a slight degradation in signal to noise ratio.

While the universal preamplifier will cater for low level sources which are likely to be required, it will not provide for a ceramic cartridge. Here, we have used a quite different circuit. Two high gain NPN transistors are employed. Tr10 is connected as a common-emitter stage with a high-value collector load of 100k and



SOURCE	R1	R2	R3	R4	C1	C2	C3
MAGNETIC CARTRIDGE	56k	150Ω	4.7k	56k	220μF 6VW	056	015
MIC (HI IMP)	100k	—	100k	LINK	—	—	—
MIC (LO IMP)	100k	150Ω	100k	LINK	220μF 6VW	—	—
GUITAR	100k	—	33k	LINK	—	—	—

Above is the circuit and component table for the universal preamplifier boards.

MIXER SPECIFICATIONS:

Eight input stereo mono mixer with automatic noise muting, level metering, bass and treble controls and stereo headphone socket. All input and output connections are made via 6.5mm jacks.

MIXER SECTION:

Frequency response at nominal output: 30Hz to 70kHz between -1 dB points; -3 dB points at 10Hz and 150kHz.

Tone Controls: $+11$ dB, -10 dB at 10kHz; ± 10 dB at 100Hz. Variable slope, constant turnover Baxandall circuit.

Sensitivity (without preamplifiers): 40mV at 5k input impedance for rated output of 0.775V RMS. Input impedance may be increased with a series resistor in the input circuit, with consequent reduction of sensitivity.

Maximum Output Signal: 5V RMS; with headphones connected the output signal clips at just above the rated output of 0.775V RMS.

Output Impedance: 4.7k for stereo mode; 2.35k for mono mode. Output signal levels are halved when both channel outputs are connected together for driving a mono amplifier.

Headphone socket: To suit any low impedance dynamic phones of 8 ohms or more.

Maximum control interaction: Less than 0.5dB Signal-to-noise ratio: better

than 60dB with respect to 0.775V RMS output.

Distortion: typically less than 0.04% at 1kHz at rated output.

Separation between channels: typically better than -50 dB.

MICROPHONE PREAMPLIFIER (for 600 ohm microphones):

Sensitivity: 0.3mV at 100k input impedance.

Frequency response: 20Hz to 70kHz at -1 dB points.

Input overload: 10mV at 1kHz.

Signal-to-noise ratio: -42 dB with respect to rated output.

Distortion: masked by residual noise but less than 0.5%.

MICROPHONE PREAMPLIFIER (for high impedance dynamic microphones):

Sensitivity: 2.5mV at 100k input impedance.

Frequency response: 25Hz to 70kHz at -1 dB points.

Input overload: 95mV at 1kHz.

Signal-to-noise ratio: -50 dB with respect to rated output with short circuit input.

Distortion: less than 0.1%

MAGNETIC CARTRIDGE PREAMPLIFIER:

Sensitivity: 3mV at 1kHz for rated output; 56k input impedance.

Frequency response: within less than 1dB of RIAA response.

Input overload: 90mV at 1kHz.

Signal-to-noise ratio: -60 dB with respect to rated output with short circuit input.

Distortion: typically less than 0.1%.

CERAMIC CARTRIDGE PREAMPLIFIER:

Sensitivity: 30mV at approximately 3 megohms input impedance.

Frequency response: 30Hz to 70kHz -1 dB points.

Input overload: 1 volt at 1kHz.

Signal-to-noise ratio: -56 dB or better with typical cartridge connected.

Distortion: typically 0.15% at 1kHz at 300mV input.

GUITAR PREAMPLIFIER:

Sensitivity: 60mV at 100k input impedance.

Frequency response: 30Hz to 70kHz at -1 dB points.

Input overload: 140mV at 1kHz.

Signal-to-noise ratio: -59 dB with respect to rated output with short circuit input.

Distortion: less than 0.1%.

MUTE:

Max gain reduction: 30dB.

Fast attack, slow decay. Attack and decay times dependent on signal levels. Adjustable threshold and switch to deactivate circuit.

a bootstrapped bias network to give a high input impedance.

A .047 μ F capacitor connected from the emitter of Tr10 to the junction of the three resistors in the biasing network provides the bootstrapping. Bootstrapping increases the input impedance in the following way: Without the above-mentioned .047 μ F capacitor, the input impedance is determined by the product of the 22k resistor multiplied by the AC current gain of Tr10, shunted by the sum of the 330k resistor and the parallel combination of the 1M and 150k resistors. This long-winded expression adds up to about 450k, which is not adequate for good bass response from a ceramic cartridge.

Bootstrapping here makes use of the fact that the voltage gain from the base of a high-gain transistor to its emitter is very close to unity. In fact, it is typically 0.98 or more in the stage under discussion. So with the aid of the .047 μ F capacitor, 98% of the input signal is coupled to the junction of the three bias resistors.

This drastically reduces the signal current flow in the 330k resistor. By way of illustration, if 1V RMS was fed to the input of the preamplifier, the signal current flowing in the 330k resistor would just 2.2 microamps, without bootstrapping. With the bootstrapping capacitor in circuit, the signal current flow in the 330k resistor is typically reduced by more than

By making a slight alteration to the PC board for the universal preamplifier, the circuit at right can be accommodated.

30 times. In other words, the input signal "see" the 330k resistor multiplied by more than 30 times, or about 10 megohms. When combined with the product of the transistor's AC gain multiplied by the 22k emitter resistor, we find that the bootstrapping has raised the input impedance to an adequate value of about 3 megohms or more.

An emitter-follower stage, Tr11, acts as a buffer for the high collector load (100k) of Tr10 and thus provides a low output impedance for the preamplifier. Voltage gain of the preamp is about 4 times.

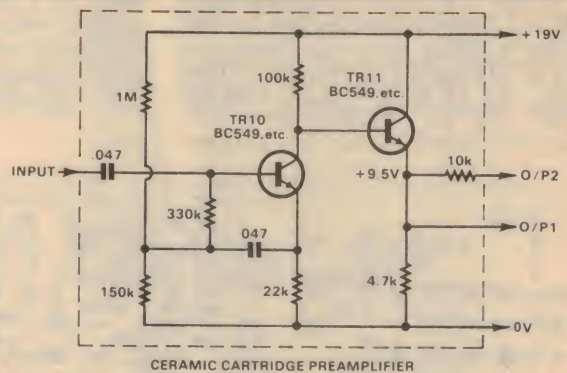
As mentioned in the first article, automatic muting is provided to improve the apparent signal-to-noise ratio of low-level sources such as high or low-impedance microphones. This is particularly desirable with low impedance microphones because

they have such a low output signal, but it can improve the signal-noise ratio with any microphone used in a noisy environment. So besides accommodating the eight preamplifier PC boards, the mother board has provision for up to eight mute boards. In the prototype mixer, only four mute boards are provided; we imagine that this will satisfy the needs of most constructors.

If all eight mute boards are required, the extra controls will mean a larger control panel. Either this or they will have to be installed on the rear panel.

Refer now to the circuit of the mute board. It uses three transistors and two diodes. As can be seen, the circuit requires two inputs, from 1 and output 2 of the associated preamplifier board.

Basically, the circuit works as follows:



CERAMIC CARTRIDGE PREAMPLIFIER

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PLAYMASTER MIXER

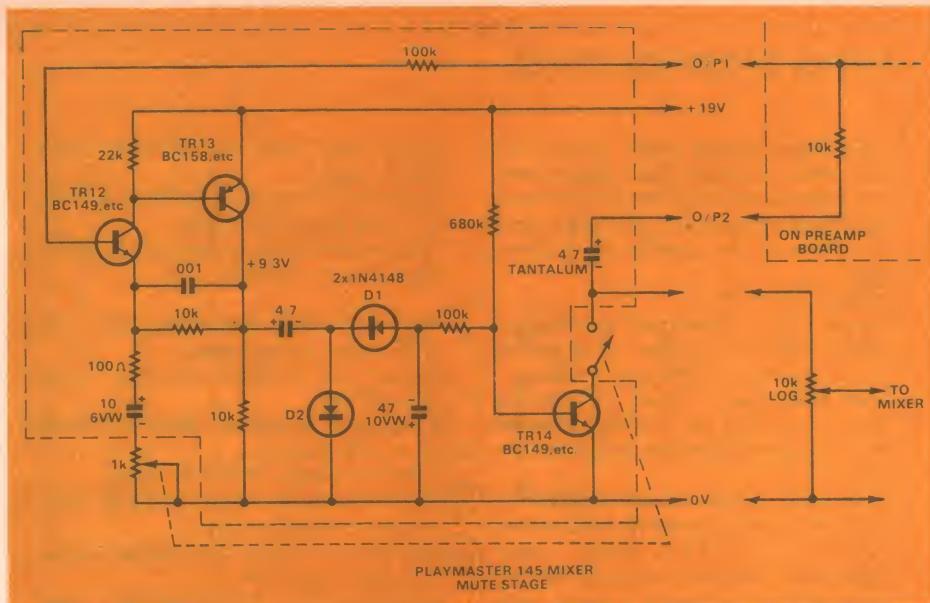
Signal is fed from the preamplifier output 2 via a 10k resistor and 4.7uF capacitor to the collector of Tr14. The 680k resistor connected to the 19 volt supply line forward-biases the base-emitter junction of this transistor and causes its collector emitter path to become a low resistance to AC signals.

In this way, the transistor can be used similarly to a FET, as an audio switch. Note that the transistor does not give as progressive a control characteristic as can be obtained with a FET, but this is of little importance in this application, since the muting action need not be progressive.

To recap then, when the base-emitter junction of Tr14 is forward-biased, the collector-emitter path becomes a low resistance, typically 100 ohms or so, depending on beta. This low resistance forms a voltage divider with the series 10k resistor (which for calculation purposes is effectively in parallel with the 10k mixing level control) to reduce the signal level by about 30dB, dependent upon the setting of the level control. In this condition, the preamplifier output is muted.

In order to get the mute circuit unmuted, Tr14 must be changed from the low resistance state to a high resistance state, i.e., it must be turned off. This is achieved by overcoming the forward bias provided by the 680k resistor with a negative voltage, developed by the mute amplifier comprising Tr12, Tr13, D1 and D2.

Tr12 and Tr13 form a complementary voltage amplifier stage with negative AC and DC feedback from the collector of TR13 to the emitter of Tr12 via a 10k resistor. Signal from output 1 of the



Four plug-in mute boards are used in the prototype Playmaster 145 mixer.

preamplifier is coupled to the base of Tr12 via a 100k resistor.

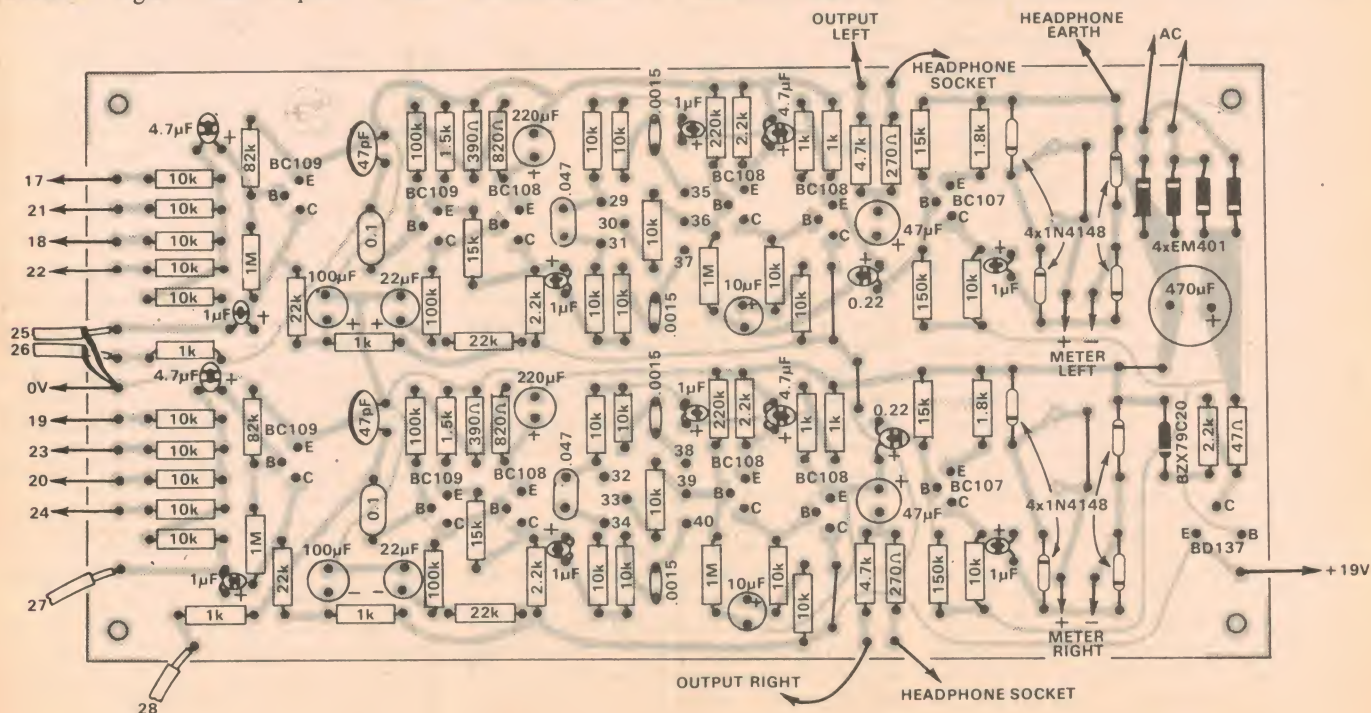
Besides signal coupling, the 100k resistor also provides the required bias voltage for the base of Tr12 (from the collector of Tr9 on the preamplifier board). This is one of the reasons for not having an output coupling capacitor on the preamplifier boards. The 100k resistor also prevents Tr12 and 13 from being driven hard into clipping when presented with a very loud signal. Thus it prevents a "click" being heard when Tr14 is unmuted.

Tr12 and Tr13 amplify the signal and feed it to a half-wave "voltage doubler" rectifier formed by D1 and D2 which develop a negative voltage across the 470uF capacitor. If the input signal to the mute amplifier is sufficiently high, the

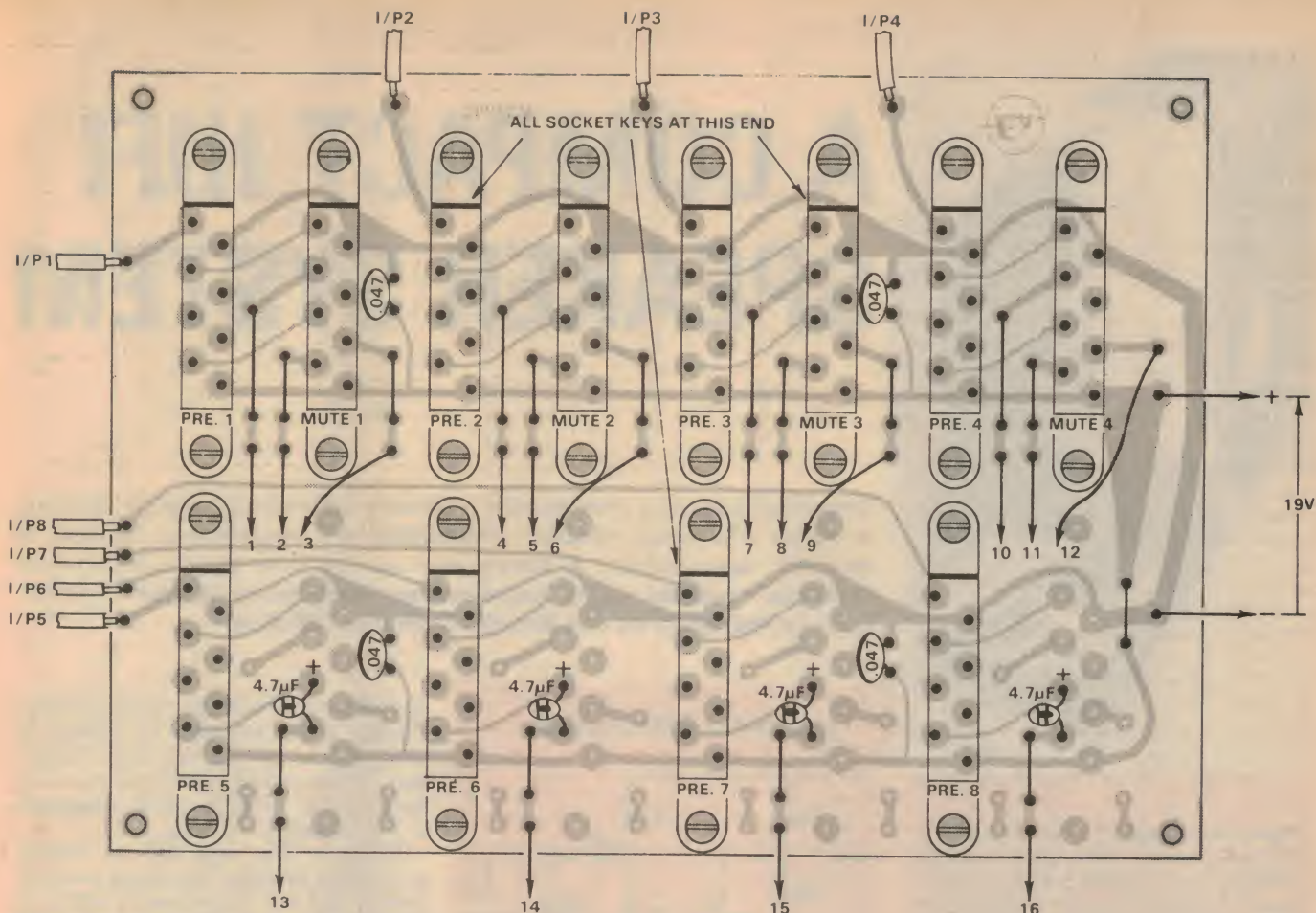
resulting negative voltage is sufficient to turn off Tr14, which stops it from shunting AC signal to the negative supply line.

The signal threshold above which the mute circuit amplifier and its associated diodes develop enough negative voltage to unmute Tr14 is dependent on the gain of Tr12 and Tr13. This is adjusted by the 1k switch/pot in series with the 100 ohm resistor and 10uF capacitor.

When the pot, which is wired as a variable resistance, is set to its minimum resistance condition (fully anti-clockwise) the gain of the mute amplifier is at maximum and therefore provides the lowest threshold for unmuting. In this condition, small signals will unmute Tr14. When the pot is fully clockwise, gain of the mute amplifier is at a minimum and so rela-



This is the component layout for the main mixer control board. All interconnections to this board are made via PC stakes.



Above is the edge connector and component layout on the "mother" board.

tively large signals are required for unmuting to occur.

Since very low frequencies are of little importance to the mute amplifier, a relatively small capacitor, 10µF, can be used to roll off the low frequency response. Similarly, high frequency response is rolled off by the .001µF capacitor in parallel with the 10k feedback resistor.

When the mixer is used in a typical set-up it is necessary to be able to disable the muting circuits while gain levels are set. Otherwise it would be possible to step up to a microphone with the appropriate gain control fully advanced but the system sounding relatively quiet. As soon as you spoke into the mic, the system would unmute and then break into the ear-shattering howl of maximum acoustic feedback!

Consequently, the switch section of the 1k pot is connected in series with the collector of Tr14. Rotating the switch-pot fully anticlockwise to operate the switch disables the muting function and enables gain levels for all channels to be set in the normal way.

Having described the major circuitry features, we can now talk about construction of the mixer. Construction can begin with assembly of the PC boards. Start with the mixer board, code 74mx12b.

Assembly of the mixer board is straightforward. ¼W or ½W resistors of low noise cracked carbon or metal film

construction may be used throughout. The board has been designed to suit PC electrolytic capacitors so these should be used if at all possible. Three 1µF capacitors in each channel should be tantalum types as marked on the circuit diagram. In several places on the board where a 4.7µF capacitor is specified we have also used tantalum types but this is not mandatory.

Quite a diverse range of transistors may be used on all the boards in the mixer. From a cost point of view, the T0-92 plastic encapsulated types such as BC548, 549, 559 are to be preferred.

A plastic encapsulated BC137 (or TIP31A) is specified for the supply regulator transistor. This is operated without any heat sink. Note that the centre lead of the transistor must be bent to insert it.

PC stakes are used for all connections to the board. Any type may be used, provided they are a tight fit in the PC board holes before soldering.

There are several wire links on the board. Note the two associated with the output to the dual meter. These are required with the meter we used in the prototype but must be replaced with suitable resistors if a more sensitive meter movement is used and/or if the rated output of the mixer is increased.

Assembly of the mother board, code 74mx12d, is equally straightforward. (Continued on page 107)

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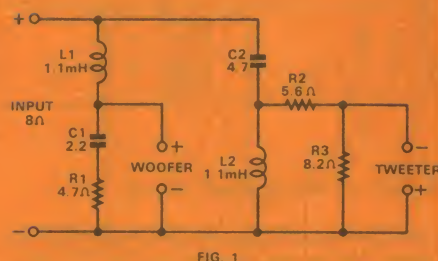
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Above: the cabinet kit as marketed by Philips Elcoma. With the materials provided, plus a screwdriver, an enthusiast can produce a well finished unit with a minimum of time and effort. On the right is the internal circuit, ready assembled on a PC board in the case of the Elcoma kit.

by NEVILLE WILLIAMS



Probably because they were reading the same market signs as we were, Philips Elcoma addressed themselves, towards the end of last year, to updating a series of complete systems using their imported range of loudspeakers.

A fair amount of similar information had already been published by Philips Eindhoven and re-issued locally. However, model changes, availability, etc, had somewhat confused the issue, making some kind of a re-statement necessary.

Over the last few months, therefore, a number of systems have been assembled and re-tested locally by Philips Elcoma and will be the subject of a company release in due course. We may reprint some of the designs later, for the interest of readers, depending on circumstances.

But learning of these local activities, we expressed an immediate interest in one of their smaller systems, having a nominal enclosure volume of 15 litres (0.53cu ft). It would obviously meet a need for an enclosure smaller than the 29 and 45 litre systems in our January issue. And, with the supply of components assured, there seemed to be good reason to co-operate with Philips Elcoma rather than generate

yet another system—just for the sake of being different.

Starting point for the new 15 litre system was one shown as "System 3A" in the Philips Elcoma brochure "High Fidelity Loudspeakers and Enclosure Designs". It specifies a Philips woofer type AD 8066/W8 mounted in a fully sealed enclosure—the type for which it was basically designed. It is mated with a Philips dome tweeter type AD 0160/T8 and a network with a nominal crossover frequency of 1600Hz. Impedance is 8 ohms and the rated power handling capacity 40 watts.

While startling at first glance, this latter figure must be discounted somewhat by the fact that the particular woofer, mounted in a sealed enclosure, is somewhat less sensitive than, say, the Magnavox 8-30 in a ported enclosure. In terms of acoustic output both would produce about the same level of sound when driven to their respective nominal power limits.

This observation is supported by the curve published for the original system 3A, which shows an upward tilt towards the treble end, indicating that the woofer is at a disadvantage relative to the tweeter.

One of the steps taken by the local Philips Elcoma was to attenuate the tweeter by about 6dB, to cut back the excess "brightness" of the system and secure an overall balance that would be more acceptable to the average hifi listener.

It was at this stage that we became involved in listening tests in our own laboratory and in a typical home situation. We agreed with the limitation of treble response but expressed some reservations about the basic cross-over network, which we felt had been over-simplified in the interests of economy.

Philips accepted this criticism and came up with a revised network which suppressed the 900Hz tweeter peak more effectively, gave a better looking (and better sounding) crossover, and a more acceptable impedance curve as seen by the amplifier. The electrical circuit of the total system is as shown in Fig. 1.

The woofer is shunted by an R/C network to offset its natural rise in impedance at the higher frequencies. Fed through a series inductor, the signal voltage to the woofer rolls off sharply above about 5kHz.

The tweeter is fed through a 4.7 uF series capacitor and shunted by a 1.1mH inductor, which rolls off the tweeter gently below 5kHz and more sharply below 2kHz. A 5.6 and an 8.2-ohm resistor reduce the signal actually applied to the tweeter and, by shunting, tend to dampen its natural resonance.

No wattage rating is shown on the three resistors, since what you can get away with depends on the nature and the level of the program material you reproduce. Our own inclination is to be generous and to use wire wound types of 3W to 5W rating.

In terms of voltage, the cross-over between woofer and tweeter occurs at about 5kHz but shifting the tweeter curve bodily upward to take into account its higher acoustic efficiency brings the acoustic cross-over nearer 3kHz. This compares

with the published figure of 1.6kHz for the original Dutch system 3A.

A point of note is that the tweeter is shown connected in opposite phase to that of the woofer. Our own experience has been that this is a rather debatable and academic course with cross-over networks of modest slope but Philips Elcoma chose to nominate this connection, consistent with the original Dutch circuit.

What is the role of a system such as this?

Basically, it is to provide good quality sound, if necessary at a fairly high level, in situations where larger enclosures cannot be accommodated. A pair of them could logically be mated with a stereo amplifier providing power in the range 15-30W RMS per channel and, in these circumstances, they would provide a very generous sound.

Again, because they are compact, not too expensive, and relatively "uncoloured", they could be used equally well as the rear loudspeakers for a quality quadrasonic system.

How would they compare with the 2-45L system described in January (page 39) using a Magnavox 8-30 main driver and a larger, ported enclosure? On average program material, the differences would be very small. The larger system is marginally more sensitive, and marginally brighter because the tweeter has not been attenuated. Output is also sustained better in the extreme bass register and this will show up if the program material calls for it.

Build the larger system if you can accommodate it conveniently. But don't feel cheated if you can't, or if the extreme simplicity of the Philips Elcoma kit proves irresistible. For all practical purposes, you will be just as happy with the results.

Now to the constructional side:

Constructors working from basic materials could make up the necessary inductors on the bobbin which we conventionally recommend, as shown in Fig. 2. Bobbin and cheeks can be from any suitable non-metal (plywood, masonite, etc) glued together or clamped by a 1/8in bolt.

At 1.1mH, the inductors would be only fractionally larger than the 1mH specified on this bobbin back in 1964, and would require 212 turns of about 18B&S or 19SWG gauge enamelled wire. Both inductors are of the same value.

The 2.2uF and 4.7uF capacitors should be of the polyester or polycarbonate variety, although the 2.2uF could be made up from two 5uF electrolytics connected back-to-back, equivalent to a 2.5uF non-polarised electro.

Recommended dimensions for the enclosure are shown in Fig. 3 reproduced from Philips literature. The diagram assumes the use of 18mm (3/4in) material, these days probably particle board. It also assumes the kind of construction which is most likely to be used by a handyman working only with bench tools; hence the butt joints and internal cleats.

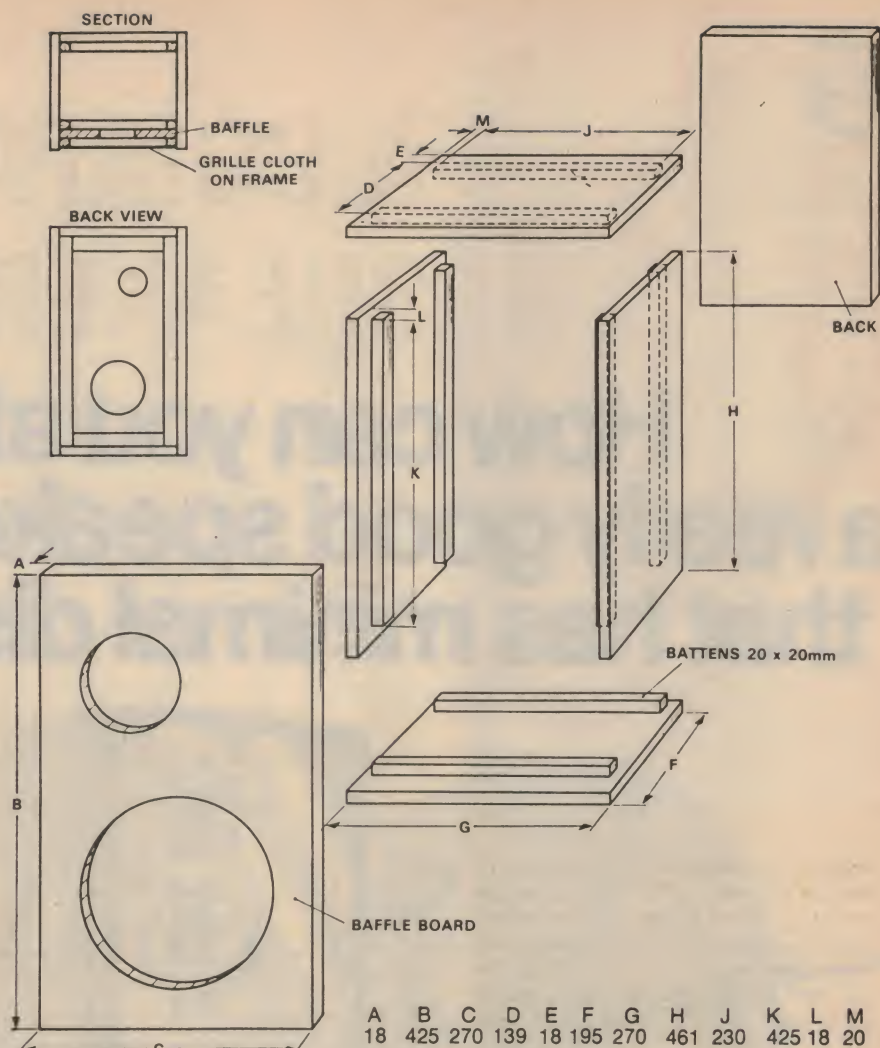


Fig. 3 above, adapted from a Philips publication, shows the recommended dimensions in millimetres for a 16-litre enclosure suitable for use at either shelf or floor level. The constructional method may be varied to suit individual preferences and facilities but the internal volume should not be altered. The design also pre-supposes the use of the loudspeakers specified: a Philips AD/8066/W8 woofer and an AD 0160/T8 tweeter, both mounted and sealed from the front. The completed enclosure, pictured below, is the unit made up from the Philips-Elcoma kit, which comes complete with pre-assembled push-in fret.



Built in this fashion, the enclosure would most logically be covered with wood-grain or other vinyl cloth, or a laminate, or even iron-on veneer—the purpose being to cover the edges and butts, along with the rest of the surface. Other constructional methods could be used, if better facilities are available, the important point being to plan for the same internal dimensions. The presence or absence of cleats, or the exact size of cleats need not enter the calculations.

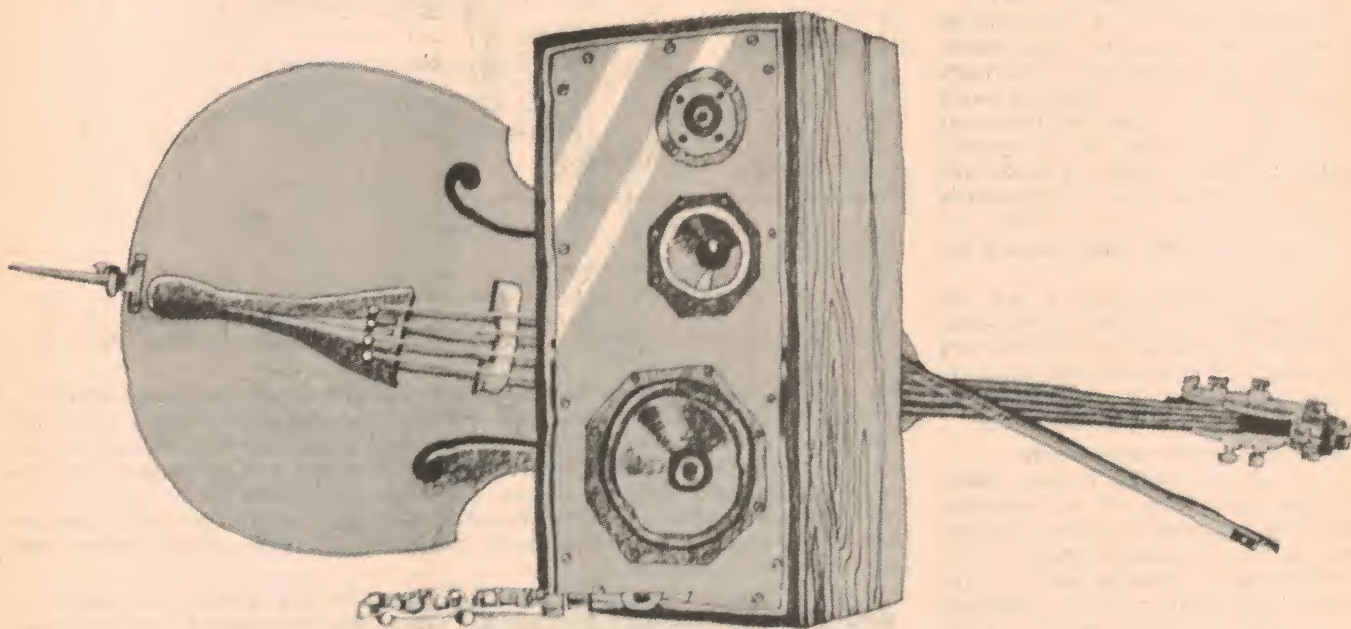
Whatever the constructional method, the enclosure must be rigid and completely airtight—an aspect that is particularly important in a fully sealed design. Joints should therefore be snug fitting, glued, and either pinned or screwed.

The trend, these days, is to fix the back permanently in position by the same means. This done, the basic enclosure can be examined for air leaks and either caulked where necessary or supported at the appropriate angles, while a trail of



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ELCOMA

153-64

LOUDSPEAKER SYSTEM

PVA glue (Adquadhre, etc.) is run along the various joints.

At this stage the output connections can be considered. If terminals of screwed connections are to be provided, make sure that the fitting is airtight. Alternatively, a flying lead can be used, normally of figure-8 colour coded flex, passed through a carefully drilled hole in the back, and caulked.

Now pad the entire back, sides, top and bottom with a 25mm layer of Innerbond, or similar material, fastening it into position with staples or large drawing pins. Either that or it can be held in position with glue.

Turning now to the baffle board, the design assumes that both loudspeakers will be mounted from the front. To accommodate the woofer a circular hole needs to be cut of 180mm diameter, on the centre line of the baffle and about 140mm from the bottom of the baffle.

For the tweeter, the basic hole should have a diameter of 74mm, being centred about 85mm from the top of the baffle and 95mm from the side. Two clearance slots need to be filed for the connecting lugs. The diameter of the loudspeaker mounting holes is critical in both cases, but their exact position on the baffle is not.

If desired, a stereo pair can be made as a mirror image so that the tweeters can be to the outside in both cases—or to the inside, depending on whether it is desired to increase or decrease the separation. It's only a minor point, however.

With a fully home-made enclosure and cross-over network, it may be wise to make the baffle removeable so that access does not depend on the speaker cutouts. However, if the baffle is made removeable, it must fit snugly to make an airtight seal, and be screwed down firmly.

Before installing the baffle, mount the divider components on its rear face and leave enough wire for the two loudspeakers accessible through the cutouts and suitably marked or colour coded. The layout of the cross-over components and the method of mounting is not critical, as long as the proper connections are made. We have seen them mounted on PC boards, on tagstrips, and even on brass pins driven into the baffle itself. The face of the baffle, by the way, and the mounting screws can well be blackened with flat paint, blackboard paint being an obvious choice.

As mentioned earlier, the two loudspeakers should be mounted from the front, making sure that they fit snugly into the cutouts. Philips suggest that constructors do not rely purely on the mating surfaces. They suggest that a thin ring of non-hardening caulking compound be laid outside the edge of the cutout so that the loudspeaker frames will squeeze down against it. Do this, then, remembering first

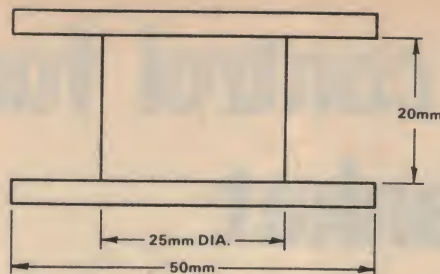


FIG. 2

Above: the recommended bobbin size for those wanting to wind their own chokes. Below, reproduced somewhat less than full size, is the basic layout of the divider board in the Philips Elcoma kit. It cannot be reproduced privately because the tiny ferrite-cored bobbins are not available as separate items.

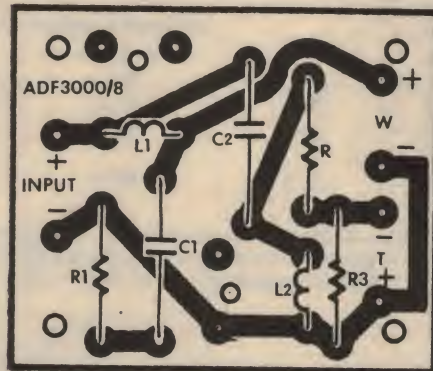


FIG. 4

to connect the appropriate leads.

The remaining item is the frame to carry the grille cloth. Make the frame from (typically) 20mm dressed timber, allowing space for the cloth to fold around it. Square up the frame, apply glue and allow to set.

If you have a good stapler, the cloth can usually be folded around each edge in turn, taking care to keep the cloth grain straight, and keeping it taut, without bending the frame inwards. If necessary, carefully trim the cloth at the corners so that it does not bunch up.

An alternative and more tedious approach is to pin the cloth to a flat surface, coat the face of the frame with a clear glue, place the frame on the cloth and allow the glue to set. Later the cloth can be folded around the edges and secured at the back by any available means.

Some constructors pride themselves in being able to make grille frames which are a push fit into the front of the enclosure. If it doesn't work out this way, four small scraps of Velcro or similar tape can be stapled or glued to the the mating surfaces. Velcro is normally obtained from haberdashery counters.

This done, your enclosures are complete and ready to use.

But, let's say that you lack the where-

withal to tackle construction of a system from raw materials. This is where Philips Elcoma can be of special assistance.

They are offering through normal trade outlets a complete kit for two such systems, ready for assembly in the home, with no more than a screwdriver and a piece of scrap rag! Working space is necessary, but certainly not a workshop.

The Philips Elcoma kit comprises two 1-inch dome tweeters AD0160/T8, two woofers AD8066/W8, two made-up crossover networks ADF3000/8 and two enclosure kits with grille frames assembled. All the oddments are included: colour-coded connecting leads already attached to the divider network, Innerbond damping material, wood screws, caulking compound and wood glue. No soldering is necessary because the leads for attachment to the loudspeakers are fitted with push-on clips similar to the automotive type. Last but not least is a sheet of step-by-step instructions.

Two items in the kit are of particular interest. The first is the crossover network, which is assembled on a small PC board, as shown in Fig. 4. It can be of this size only because the inductors are very small, being wound on a special bobbin and a core of magnetic material. The bobbin, core and PC board are not available as separate components but Philips Elcoma advise that the complete crossover network (type ADF3000/8) will be available separately, with leads already attached.

The other major item of interest is the enclosure itself. Following modern mass production methods, this is basically a single board, surfaced with walnut grained vinyl, from which had been milled slots for the baffle and back, and V-cuts where it folds. It comes as a fully surfaced enclosure, with pre-stained baffle and back loosely in position, and virtually held together by the vinyl covering and a strip of tape.

To assemble the enclosure, it is opened right out on an adequate flat surface. Glue is applied to the milled slots of one side, and the baffle and back laid in position. Glue is also spotted on to the inner surface and the Innerbond pressed against it. Glue is then applied to the top, side and bottom in turn, in the milled spaces and to the V-grooves. The innerbond is placed in position and the top, side and bottom folded around the baffle and back. Adhesive tape along the last joint will hold the enclosure together while the glue sets.

With the divider network in position, the loudspeakers can be secured, the grille frame slipped into place and the job is done.

Proposed retail price for the complete kit for a stereo pair of loudspeakers (Philips Elcoma kit AD8K40) is \$115. Alternatively, a pair of systems can be supplied fully assembled and ready for use at \$137.

Next month:

FREE LIFT-OUT: DICK SMITH CATALOG

Electronic control for electric blanket

An article on electric blankets may seem out of place at this time of the year, but winter is only a few months away. Don't wait until you need this controller before you start to build it. Build it now — then you won't wake up shivering in the middle of the night at the first cold snap.

by ERYL L. JOHNSON*

The main disadvantages of thermostatic blanket controllers are the annoying clicks of the thermostat during the still of the night, the maintenance to the contacts required after several years operation and the broad range above and below the actual setting due to the hysteresis of the thermostat. The device described here will provide precise continuous control of the blanket power, under the control of an ambient temperature sensor. Provision is made for manual control of the blanket for pre-heating.

From practical observations, it was found that the average person (if there is such) requires some form of electric blanket heating when the temperature falls to 8 degrees C, and full heat at a temperature of -2 degrees C. This is a relatively small range, such that the change in a thermistor can be expected to be only 40 per cent of its resistance at 8 degrees C.

The circuit is designed around a phase control device manufactured by Amalgamated Wireless (Australia) Limited, type AWN 1437. This device will vary the conduction angle from 7 degrees to 173 degrees for a nominal voltage change of 0 to 6V on the control input. It generates its own regulated supply from the line voltage and provides a trigger pulse for triacs.

The sensing element is an NTC thermistor. The type used in the prototype was a KBS102 manufactured by Standard Telephones and Cables Pty. Ltd. Depending on the method used to mount the device, type FS23B, F23D, G23B or D23 would also be suitable with no circuit amendments. In the current uncertain supply situation, it may be necessary to use one of the latter types. The prices are similar, the G23B, for example, is currently available at \$1.48.

The AWN 1437 will generate a trigger pulse to the triac gate after only 7 degrees of each line voltage half cycle when the control input, pin 2, is at 0V. For practical purposes this gives full power in the load. When pin 2 is raised to +6V the trigger pulse is delayed to 173 degrees giving virtually no power in the load. These are nominal voltages only; in the original unit the actual control voltages were: maximum power +1.6V, minimum power +5.2V. To operate the sensor circuit, a regulated voltage of +6.5V, 2mA max, is available at pin 10.

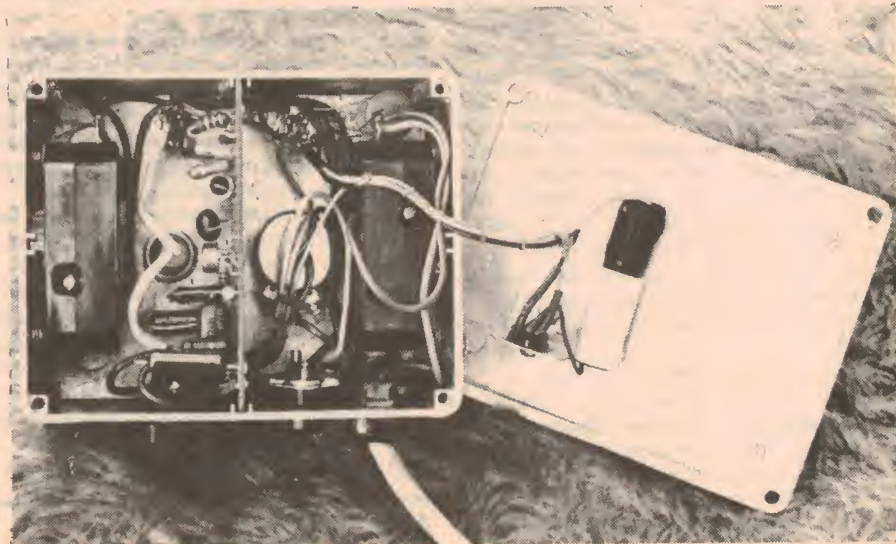
The KBS102 NTC thermistor has the following approximate resistances (as calculated from the manufacturer's specifications):—

		Equivalent values for G23B	
deg. C	ohms	ohms	
8	2055	3159	
2	2708	4050	
-2	3276	4809	

The thermistor is required to dissipate little power, so its temperature is controlled by the air temperature and not its own dissipation.



The finished controller. The two switches provide automatic or manual control to the two outlets, independently.



Interior view of the controller. The Veroboard panel is supported in guides in the centre of the box. The control pot is to the right of the board and the indicator lamp to the left. The triac, on a bracket, and the ferrite rod are mounted on the lid.

It is connected in the base circuit of a transistor type BC108 (2N3569 or similar) operating as an inverting amplifier. As the temperature falls the resistance of the thermistor increases, raising the base voltage to cause an increase in collector current. The voltage at the IC pin 2 therefore falls to give an earlier trigger pulse to the triac. Preset adjustments are provided to compensate for tolerances in the thermistor resistance, transistor beta and the IC regulated and control voltages.

The power consumption of most blankets is only 23W, or for a dual blanket 46W, but some automatic blankets may have ratings up to 65W (dual 130W). These should all be well within the ratings of the triac suggested, but any medium current triac would be satisfactory.

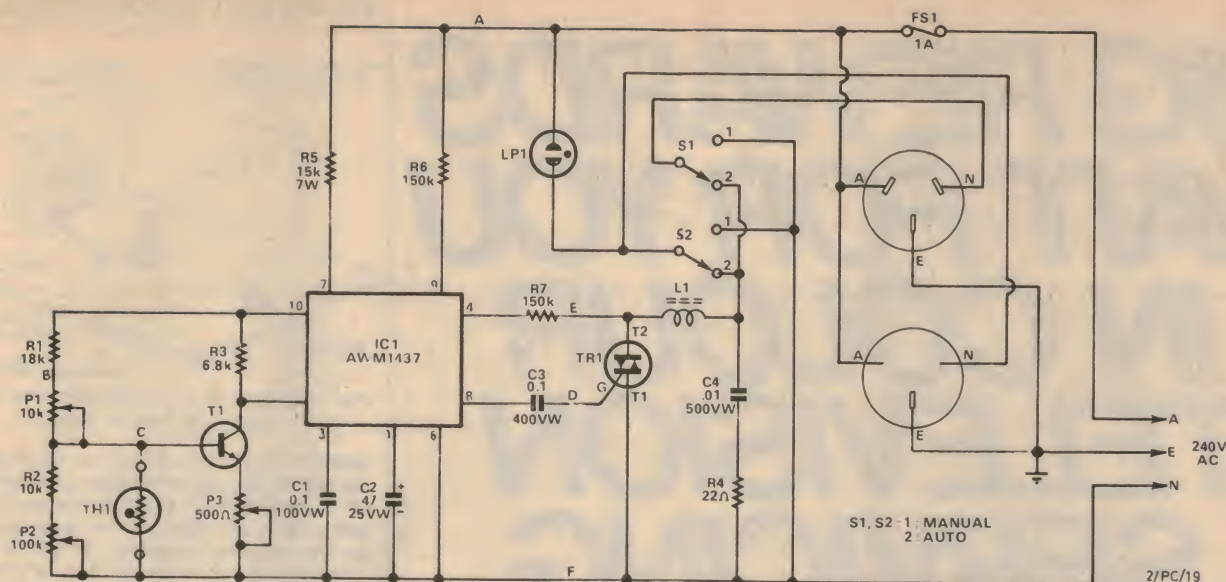
To monitor the output power, a 240V neon lamp has been provided across one of the output points. This type of lamp is not normally considered suitable for analogue measurements, but in practice provides a reasonable measure of power, giving a graduated brightness from approximately 20 degrees up to full power.

RF interference to other services is always a problem in phase control devices. It is reduced to a low level by the filter L1, C4, R4.

The original unit was constructed in a diecast box measuring 4 3/4 in x 3 3/4 in, the lid being fitted with small feet and becoming the bottom. The smaller components mount on a piece of 0.1 in veroboard, which fits into the guides in the box. Flush mounting mains sockets are used for the two output points and are mounted on each end of the case. A hole saw can be used to cut circular holes in the diecast material.

The triac is mounted on a small bracket, insulated from it by means of mica and nylon washers which are usually provided

* 176 Risdon Rd, Moonah, Tasmania, 7009



2/PC/19

Heart of the circuit is the AWM1437 IC which varies the conduction angle according to the control voltage applied to pin 2.

with the device. Thermal conduction is not very important due to the low current required. The bracket is screwed directly to the lid.

The thermistor must be thermally insulated from the case, due mainly to the heat generated by the 7W resistor R5, and electrically insulated, as it is connected directly to the mains neutral. A suitable method is to connect it to the main circuit using a length of 3 core miniflex directly wired to the circuit board and fed through a grommited hole in the case.

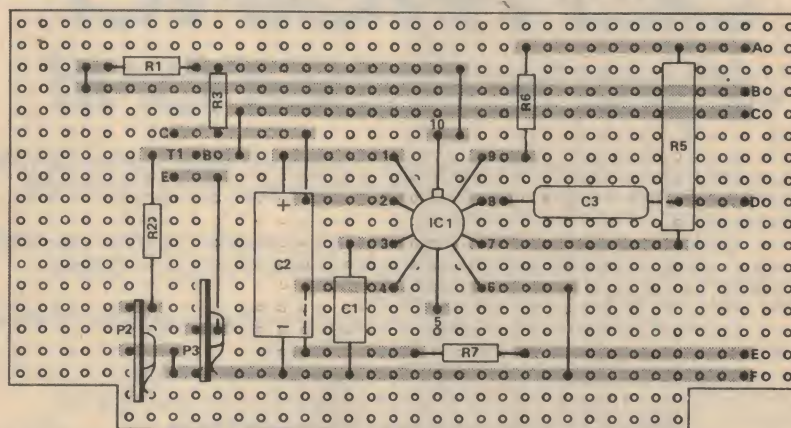
The thermistor can be mounted on a small aluminium bracket, which is earthed via the flex. The original unit was insulated by potting it with Araldite. A mould can be made of cardboard and removed when the Araldite hardens. The unit can be filed square and finished by spraying with lacquer. If required to be mounted on the wall or bed, a keyhole can be fashioned in the bracket before potting. Fig. 2 shows the construction.

The circuit board is constructed from a piece of 0.1in Veroboard, 9.2cm x 4.8cm, with cut-outs to allow wiring within the case. Care should be taken when bending the IC leads to fit the board, that the seal is not broken. The leads should be kept straight for $\frac{1}{8}$ in from the IC before bending. A heat-shunting clip or a pair of long-nosed pliers should be used to prevent damaging the device when soldering it to the board.

Make sure that all mains wiring is insulated and that the active and neutral are correctly connected. The mains earth wire must be connected to the case, a solder lug under a 3 pin socket mounting bolt and nut provides a convenient connection point.

Inductor L1 is made by winding two layers of 26 SWG insulated wire on a 2in piece of $\frac{3}{8}$ in ferrite rod, with a layer of PVC insulating tape between each layer and finishing with two layers of tape. The inductor may be mounted on the baseplate under a manilla paper bracket as shown. The lead out wire should be carefully insulated with PVC tubing, anchored under the PVC tape. Capacitor C4 and resistor R4 mount across switch S2.

The dissipation in resistor R5 is 4W, so it should be located clear of the IC. In the original circuit, this was made up of 2 x 6k



The Veroboard assembly from the component side. Note that R5 is mounted 70mm clear of the board and that unused lugs on P2 and P3 are bent so that they do not enter holes in the board. Points "A" to "F" (right) correspond to the same points on the circuit.

3W resistors and 2 x 1.5k resistors in series, giving 15k 8W. A satisfactory alternative is the quoted 15k 7W resistor. Another alternative would be 7 x 2.2k 1W in series, with minor amendments to the circuit board.

The case can be sprayed with hammer-tone finish to make a professional job. Designations can be completed with Letraset, covered with clear lacquer.

Unless a temperature controlled area is available, the following procedure is a convenient method of setting the initial

calibration.

(1) Obtain two resistors which are equal to the thermistor resistance at the highest and lowest temperatures required. Suitable values are:

KBS102
 R_h 8 deg. C 2.2k in parallel with 33k
 R_l -2 deg. C 3.3k

FS23B, F23D, G23, D23
 R_h 3.3k in parallel with 68k
 R_l 4.7k

(2) Set P1, P2 and P3 to mid-range and

PARTS LIST

1 Diecast box I.T.T. 43 B00

1 Neon bezel

1 Fuse holder

1 Fuse 1A

1 Knob

2 Mains socket Clipsal 412

1 Mains plug Clipsal 439D

2 SPDT switches

Veroboard, 0.1in

Ferrite rod $\frac{3}{8}$ in x 2in

3 Core Flex

4 Rubber feet

2 Grommets

SEMICONDUCTORS

1 Integrated circuit AWM1437

1 Transistor BC108

1 Triac T1C216D

1 Thermistor KBS102 (see text)

CAPACITORS

1 .01uF 500V ceramic

1 0.1uF 100V greencap

1 0.1uF 400V polyester

1 47uF 25V electrolytic

RESISTORS

$\frac{1}{2}$ W unless specified

1 22 ohm

1 6.8k

1 10k

1 15k 7W

1 18k

2 150k

POTENTIOMETERS

1 500 ohm preset

1 10k panel mounting type

1 250k preset

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BLANKET CONTROLLER

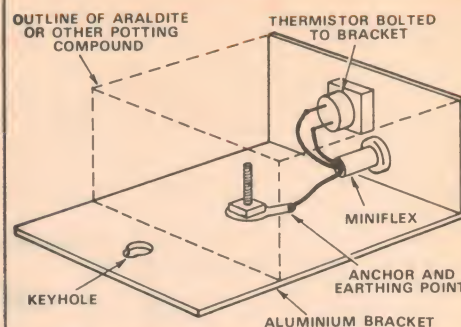


Fig. 2: Detail of the thermistor box, which becomes a "remote sensor".

connect R_h in place of the thermistor. Adjust P2 until the controller just switches off. A 40-60W lamp may be used as a load and a CRO, AC voltmeter or the neon lamp used to observe the power in the load.

(3) Replace R_h with R_l . Adjust P3 until full power in the load is just achieved. A large adjustment here will alter the setting of P2.

(4) Repeat 1 and 2 until both settings are correct.

(5) Connect the thermistor. After stabilising at a temperature of 8 degrees C, check that the controller is on the verge of supplying power to the blanket by slightly varying P1. In the original unit P1 was provided with a knob adjustment on the front panel to allow easy variations of the calibration, depending on the individual's preference.

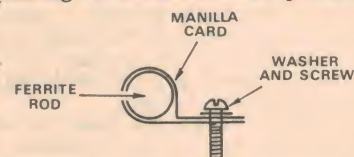


Fig. 3: Ferrite rod (L1) mounting details.

In practice, it was found that one hour on blanket position 3 is required to preheat the bed (controller switch on MANUAL), then the controller is switched to AUTO and the blanket to position 1. Again this depends on the individual. ②

PLEASE NOTE

This project is one contributed to our recent Kitsets-EA Competition. As such, it has not been through our laboratory and should not be regarded as a regular "Electronics Australia" project. We will therefore not be in a position to answer postal queries about its operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributor's name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

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Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Comb or notch?

In your December issue, a letter from a Mr. Hegarty refers to a "notch" filter, yet in your reply you refer to a "comb" filter. Could you please clarify the difference between the two, and state which is correct for removing the 4.43MHz colour signal.

J. R. Wright,

Albert Park, S.A.

COMMENT: A notch filter is one which rejects a single frequency, while a comb filter rejects a number of frequencies, usually frequencies which are harmonically related. It is the latter type which one would use to delete chrominance information from video, as the information exists as a series of "packets" at frequencies spaced midway between the luminance information packets — which are in turn spaced at multiples of the line frequency. A notch filter at 4.43MHz is not effective, as very little information is present there — the subcarrier is suppressed in any case. It is rather an academic point, now, of course.

Critical of EDUC-8

The EDUC-8 may only be a toy, but there is no reason why it should not be efficiently designed. The timing board logic in particular surpasses all textbook examples in redundancy. To list several of the more obvious examples:

1. Seven of the gates in the timing decoder are equivalent to a single 8-input NAND gate, i.e., 7430. Is maximal propagation delay, power dissipation, or component count the aim of the exercise?

2. There is a redundant inverter at the input of the 4-input gate at the set input of the defer flag FF.

3. I count more than 16 NAND gates followed by inverters. AND gates such as the 7408 are no more expensive than NANDs. Three excess packages of inverters in a total of 21 is quite significant. Similarly, in 4 or more places a NOR gate could obviate an inverter at BOTH the input and output!

4. At the inputs of the run and defer flags, a gate and an inverter could have been saved by using a 3-input gate in the flag FFs themselves.

5. The FF marked "sequence counter" has a glorious array of useless paraphernalia about it. Applying feedback to a JK FF and gating it with the clock as well merely to make it toggle is ridiculous.

6. Since only 5 states are decoded the 74154 seems to be wasted. It could be replaced with 10 simple gates.

7. Now to raise a more subjective issue. I feel that your logic diagrams are not as lucid as possible. I doubt that some are standard. They seem schizophrenic. You wish to show that they perform merely as inverters, yet you wish to show more — without fully revealing that they are perhaps a 2-input or 4-input NAND. I suggest that the symbol represent the function that it performs.

I gather that three of the logic elements in the clock circuit represent a single Schmitt input gate. It does not seem correct to fragment logic functions without putting them in a box and labelling them.

I hope the constructive aspects of my criticism are beneficial.

Erik Christiansen

Yarraville, Victoria.

COMMENT: Like most designs developed in similar circumstances, and published in virtually their initial prototype form, without the benefit of further rationalisation and refinement, the EDUC-8 microcomputer design undoubtedly has its "rough edges". With the benefit of hindsight, it is easy to see places where one could simplify and make improvements the next time around. This applies particularly to the timing board, where the logic was modified a number of times, the last being when the memory was redesigned for 256 words.

Some of your specific criticisms of gate redundancy, while valid in a narrow textbook sense, ignore a practical consideration. In designing projects for home

construction, one cannot necessarily use any device in the catalogues; some will be readily available to the small-quantity buyer, others much less so. The author deliberately restricted the TTL devices used to the smallest number of readily available types with this in mind. While this inevitably introduces some redundancy, it also keeps costs down by reducing the variety of devices stocked by suppliers, and increasing the numbers of each individual type used. In practice this probably cancels out most of the saving which might have been made by attempting to achieve minimal device count.

We are always grateful for constructive criticism.

Rank colour sets

After reading the eulogistic article by the Serviceman in the December issue of EA I had occasion to examine some of the Rank colour sets. A feature which seems to be common to all sets and which even the Serviceman could hardly fail to notice is that the brightness slide control has basically two positions, flat out or black out. Furthermore, as the brightness comes rushing up from nothing to full over the last quarter of an inch, the picture blooms and changes focus in such a degree that, if it were an old cheap secondhand set one would be wary of buying it.

Having missed such glaring defects one wonders what else of a more subtle nature he overlooked. But perhaps if he got a free set out of the article he might tend to look at it through rainbow coloured glasses!

R. Hartkopf,

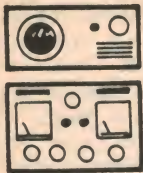
Alphington, Vic.

COMMENT: Neither the Serviceman nor any member of the EA staff has received a free colour TV receiver, from Rank-NEC or from any other source. Your implication that we would knowingly publish untrue information is therefore false, as well as insulting. As to the performance of the receivers concerned, we understand that they have become very highly regarded, both in terms of picture quality and reliability. We believe they are being widely used by rental companies, which also seems significant. This suggests that the sets you saw were very untypical. ☺

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The Serviceman

Test patterns and how to use them

So colour TV is officially here! For the serviceman and the installation technician there is a big job ahead, and doubtless a few rough patches at times. But if we do our homework — and keep on doing it — we should survive. Part of our homework is to learn about colour test patterns, and how to interpret them.

It is virtually certain that the advent of colour will arouse the critical faculties of viewers far more than did the advent of black and white TV. And since the assessment of colour quality is largely a subjective process, there are bound to be disagreements as to whether sets are performing as they should.

For this reason alone we need a standard of some kind; a standard which the technician can use to ensure that a set is adjusted correctly, and one which the layman (customer) can also understand, at least in broad terms, in order that the technician can demonstrate that a set is, in fact, working correctly.

But the need for a test pattern goes a lot deeper than that. Because of the complex nature of the colour TV signal, and colour TV sets, there is a greater risk than ever that one type of information will penetrate some part of a set which is intended to respond only to another type of information. When this happens, all kinds of strange malfunctions can occur.

To make matters worse, variations in basic signal strength, or of particular forms of information within the signal, can vary the degree of such malfunctions all the way from negligible to severe. Or, in simpler terms, a malfunction may occur only on certain channels, on certain types of program material, or combinations of these.

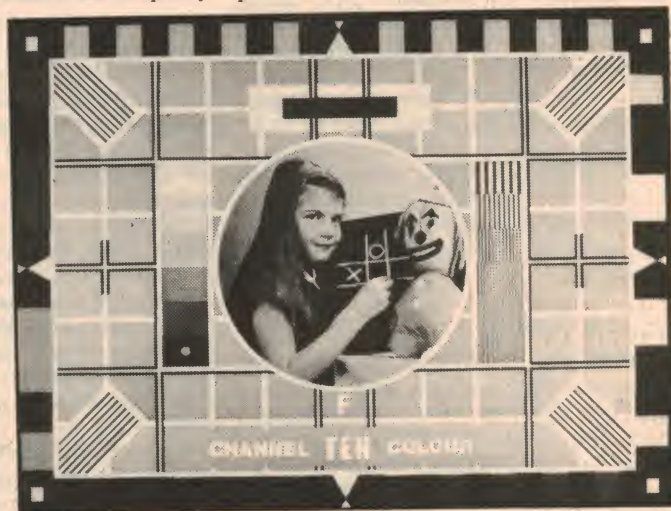
These are the situations which the colour test pattern is designed to reveal. Not only does it present the set with a far more severe set of conditions than it is likely to encounter on program material, but it is also constant, enabling the technician to come to grips with a fault far more readily than if he has to depend on the highly variable signal from program material.

The information contained in a colour test pattern may perhaps be best discussed at three levels. First there is the basic test pattern as originally used for black and white sets; it checks geometry with circles and grid patterns, definition with gratings of progressively finer patterns, contrast ratio or "gamma" linearity with step wedges, and so on.

Second, there is a colour pattern of some kind. It may be a standard colour bar pattern (yellow, cyan, green, magenta, red, and blue) and/or a pictorial presentation containing typical easily recognisable colours such as flesh tones.

The purpose of these patterns is pretty obvious and the less experienced reader may be pardoned for believing that this is about the limit of what a test pattern is intended to do. In fact, there is a lot more to most test patterns than this, but the point is that one needs to have a pretty

The test pattern "F". This was designed jointly by the BBC, ITA and BREMA. As well as the image portrayed, there is provision to insert a standard colour bar pattern in the first four lines after the field blanking period.



good idea of what faults the pattern is aimed at revealing, in order to make full use of it.

This is the third level and we hope that this article will assist readers to make the fullest possible use of the most popular test patterns currently being presented.

Australian TV stations have displayed a variety of test patterns, but the three most popular ones are those reproduced here; The BBC test pattern "F", the all-electronically generated pattern from the Philips PM 5544 generator, and the all-electrically generated pattern from the Fernseh PC-TV 408 generator.

The BBC test pattern "F" is being used by a number of stations, including channel 10 Sydney, to whom we are indebted for a colour slide from which the black and

white reproduction shown here was made. They also supplied the detailed description of the pattern, supplied to them, in turn, by the BBC. Test pattern "F" was designed jointly by the BBC, the ITA, and the British Radio Equipment Manufacturers Association. It is reproduced with their permission.

The features of the card include coloured edge castellations to check colour synchronization effects and picture size; a grid with corner diagonals and centre circle enabling picture geometry to be assessed; a "letter-box" pattern to test low-frequency effects; a six-step grey scale, and frequency gratings corresponding to 1.5, 2.5, 3.5, 4.0, 4.5, 5.25 MHz. Colour information is included in the edge castellations and in the picture contained in the centre circle.

REFERENCE GENERATOR FAULTS

The top border castellations are in cyan, which, having a high luminance component, shows up decoder errors effectively. Their location at the top of the picture monitors the recovery of the reference generator after the field-sync period, when the reference bursts are absent. Errors are clearly seen as variation in the saturation of the castellations. The bottom castellations, being green, provide a means of assessing the reference generator performance at the end of the field as compared with the start.

Red and blue castellations on the left hand side give rise to the greatest disturbance of the regenerated colour picture if the gating circuits permit picture information to pass to the reference generator. If this fault is present in the receiver, either bands of saturation changes, or "Venetian Blinds", will be visible on coloured areas across the picture, depending on the decoding circuits employed.

SYNC-SEPARATOR PERFORMANCE

The right hand castellations are yellow and white. They provide a check on sync-separator performance in the presence and absence of the subcarrier. Any malfunctioning of the sync-separator circuit will appear as variations in the position of the picture content. This is most

readily identified by reference to the right hand castellations, the right and left hand castellations having been staggered to make it clear from which side any disturbance arises. This also gives the maximum possibility of phase change resulting from a gating error.

RESOLUTION

The bars in the frequency gratings are of square-wave form as this is more satisfactory for the intended purpose. Allowance is made to control the modulation depth, to avoid over modulation resulting from the parameters of the system.

CONVERGENCE CHECKING

Certain lines in the grid have been outlined in black to assist checking display tube convergence. Others have no outlining in order to avoid the confusion which might otherwise result from the low-frequency ringing seen when certain types of quadrature distortion are present in a receiver. The black board and white cross provide a check on static convergence, allowing this to be set correctly in the centre of the screen.

THE COLOUR PICTURE

The colour picture in the centre circle contains flesh tones and bright colours to facilitate overall picture quality assessment and the correct setting of saturation. A child was chosen as the model rather than an adult so as to avoid the effects of changes in make-up fashion.

The circle containing the colour picture is outlined in white to avoid any 'optical illusion' effects which might occur if the coloured areas abutted directly on to the back-ground grey and white grid. It must be emphasised that Test Card 'F' is intended primarily for technical purposes and is only secondarily a demonstration picture. Further, although provision is made for the critical appraisal of convergence the test card is not intended as a substitute for a grid pattern generator when setting convergence.

CONTRAST

To the left of the centre circle is a column of six rectangles with a contrast range of about 30:1 between the top and bottom squares. The difference in brightness between adjacent rectangles should be constant on a correctly adjusted receiver. Within the top and bottom rectangles are small lighter spots; white or black crushing is shown by the merging of the top or bottom spot into its surrounding area.

ASPECT RATIO

The central white ring should appear truly circular when the width and height of the picture are adjusted to the standard aspect ratio of 4:3.

PICTURE SIZE

The transmitted picture is slightly smaller than the test card illustrated; its limits are indicated by the points of the opposing arrowheads in the border. As most monochrome receivers have a display area with an aspect ratio of about 5:4, it is usual to adjust these receivers so that the top and bottom edges of the

display area coincide with the arrowheads, and the side castellations of the test card just appear in the display area of the receiver. In this way the correct aspect ratio of the picture is obtained. Modern colour receivers use picture tubes with an aspect ratio of 4:3 thus the height and width controls should be set so that the arrowheads on all four sides just touch the edges of the display area.

RESOLUTION AND BANDWIDTH

At the right of the centre picture are six gratings corresponding to the following fundamental frequencies in MHz:

1.5	4.0
2.5	4.5
3.5	5.25

These are square-wave signals, and on a

on the same level as the lighter toned rectangles in this side; it will also give the central ring the appearance of a "cog-wheel".

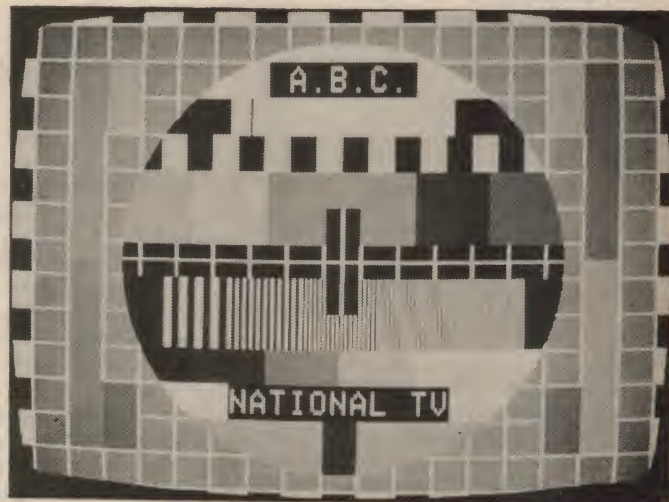
REFLECTIONS

If there are reflections of the television signal, from hills or large buildings, these may result in displaced "ghost" images of any significant feature of the picture. This effect will be most readily seen as displaced images of the white or black vertical lines, particularly where these are adjacent.

UNIFORMITY OF FOCUS

In each corner of the test card there is a diagonally-disposed area of black and white stripes. The focus of these areas and of the central area of the test card should

The Philips PM 5544 pattern. This picture is from a colour transparency of a monitor screen. The station identification is from an alpha numeric generator fed to an input socket on the generator.



correctly adjusted receiver will appear to extend in value from white to black, with their surroundings area white. An effect called "crosscolour" will be evident on the 4.5MHz grating.

This frequency falls within the chrominance bandpass of the receiver decoder and gives rise to a "red-blue" colouration. Some crosscolour may also be apparent in the diagonal bars in each corner of the card.

SCANNING LINEARITY

The white lines in the background should enclose equal squares and the central white ring should appear truly circular.

LOW FREQUENCY RESPONSE

Low-frequency response can be checked by the black rectangle within the white rectangle at the top centre of the test card. Poor low-frequency response shows as streaking at the right-hand edges of these areas and also of the border castellations.

LINE SYNCHRONISATION

The border of the test card is a pattern of alternate rectangles in black and colours with a high luminance value. On black and white receivers these rectangles appear as black and various lighter tones from grey to white. The right side of this border serves as a test signal to check the line synchronization of receivers. Faulty line synchronization shows as horizontal displacement of those parts of the picture

be uniform.

COLOUR BARS

All the features of the pattern just described are normally generated from transparencies in a flying spot scanner. In addition, there is provision to insert a standard colour bar signal in the first four lines following the field blanking period, immediately prior to the top castellation pattern. Such a signal is best generated electronically in order to achieve the highest possible colour accuracy.

The colour bar pattern can be viewed on a CRO if the latter is triggered by the field synchronizing pulses. It is not normally visible on the face of the picture tube if the picture has been adjusted for normal height, but can be brought into view by reducing picture height, or by deliberately "rolling" the picture with the vertical hold control.

PHILIPS PM 5544

The Philips generator PM 5544 produces a very versatile and useful electronically generated pattern. It is being used by a large number of Australian TV stations and, provided one knows what to look for, it will check just about everything one would wish to check in either a black and white or colour set.

ASPECT RATIO

The circle should be quite round at the correct aspect ratio. Since the accuracy and stability of the generated circle are

very high any deviation from the circular shape is due to an error in the deflection system. (It should be remembered that distortion of the circle may be due to non-linearity as well as to an incorrect aspect ratio.)

PICTURE SIZE

The top and bottom border castellations provide a check on overscan. The castellations at the left-hand and right hand sides will be cut away in case an aspect ratio of 4 : 5 is used instead of the standard 3 : 4 ratio.

LINEARITY

The rectangles formed by the horizontal and vertical lines should be squares if correct linearity is realized. The circle should be round.

CONVERGENCE

Static convergence can easily be checked (and adjusted if necessary) with the aid of the horizontal and vertical lines in the middle of the circle. Dynamic convergence can be checked using the cross hatch information around the outside of the circle.

SYNC SEPARATOR CHECK

The right-hand black/white castellations give a check on the functioning of the sync separator. Any error here will cause the vertical lines to be displayed as zigzags.

INTERLACE

A special trick has been employed for checking interlace. The horizontal lines of the grid raster are made up of two lines, each from a different field. The horizontal line in the middle of the circle is built up in the same way, except that the scanning sequence is reversed.

For example, if the raster lines consist of one line each from the odd and even fields, in that order, then the centre line will consist of an even and odd line, in that order. Faulty interlacing will cause one pair of lines to be closer together than they should be, while the opposite pair will be further apart. This means that the widths of the two lines will be visibly different.

LOW FREQUENCY RESPONSE

Low-frequency response can be checked by means of the black rectangles in the upper and lower parts of the circle; streaking at the right-hand side of these blocks indicates poor low-frequency response.

TRANSIENT RESPONSE

The 250kHz square-waves, just above the colour bars, give a clear impression of the transient response. Overshoot, undershoot and ringing are all reflected in the square-wave signals. In order to avoid quadrature distortion, the amplitude is limited to 75%.

DEFINITION

The definition lines correspond to frequencies from 0.8 to 4.8MHz and have a sinusoidal form. The fall-off of the amplitude of these lines gives a clear indication of the bandwidth. On a normal TV set the 0.8 to 2.8MHz lines should have full amplitude, whereas the 4.8MHz lines

will have a small amplitude. The percentage drop can be measured with the aid of an oscilloscope.

DELAY LINE

The delay-line circuit can have amplitude or phase errors, i.e., either the amplitude or the phase, or both, of the direct and the delayed chrominance signals may differ.

The vertical columns of grey squares on the far left and right hand sides, designated "colourless R-Y (or B-Y) information", are used to check this condition. In the R-Y group, each alternate line is either a $-(R-Y)$, or a $+(R-Y)$, and in the B-Y group $-(B-Y)$ and $+(B-Y)$.

First, the amplitude check. When these alternate lines are compared via the delay line they will, if free from amplitude error, produce a neutral grey. If an error is present they will produce a "Venetian blind" effect. In the case of a simple PAL receiver the error will produce very marked Venetian blind effects.

Phase errors between the delayed and the direct signals are detected in much the same way as the amplitude errors, but here the "Venetian blinds" appear mainly in the (R-Y) and (B-Y) sections (i.e. the non alternating ones immediately adjacent). For example, phase errors may cause (R-Y) signals to appear in the (B-Y) section, thus giving a change of hue in alternate lines. Since the cyan and green blocks of the colour bar both contain considerable (R-Y) and (B-Y) components, a phase error also gives an easy recognizable Venetian blinds effect here.

REFERENCE PHASE

The "colourless R-Y information" is also used to check the (B-Y) synchronous detection. Due to the PAL coding of this signal a non-alternating phase-switched (R-Y) signal arrives at the (B-Y) output of the delay-line circuit, and consequently at the (B-Y) synchronous demodulator. Only when the phase of the subcarrier

signal fed to the synchronous demodulator is exactly orthogonal to the phase of the signal modulated with (R-Y) component will no output signal be obtained. In any other situation, the section has a more or less visible colour.

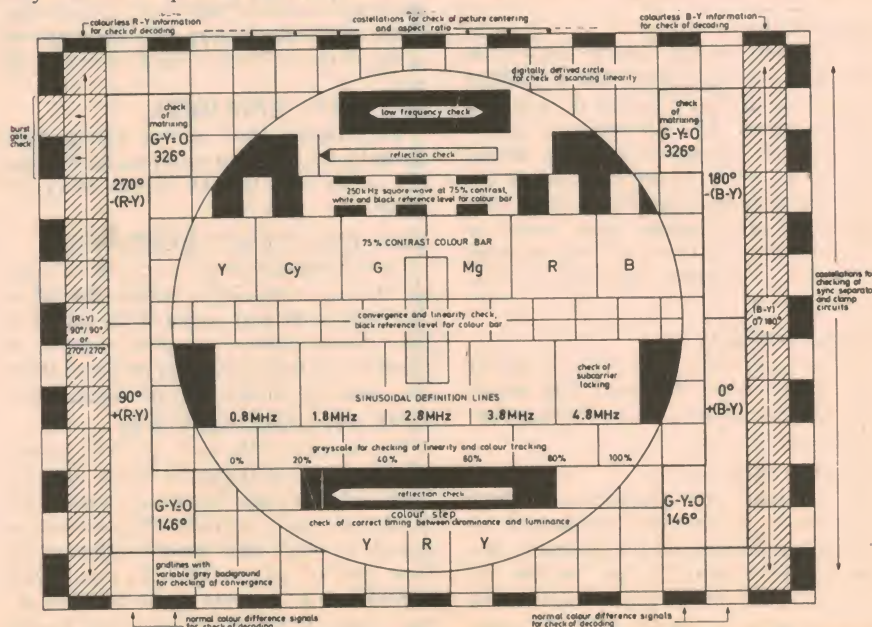
The "colourless (B-Y) information" is used to check the (R-Y) demodulation. This (B-Y) signal appears at the (R-Y) output of the delay line and consequently at the (R-Y) demodulator. As in the previous sub-section, only when the phase angle between the subcarrier applied to the demodulator and this (B-Y) modulated subcarrier signal is 90° will the right hand vertical $\pm (B-Y)$ bar remain colourless. It will be clear that in both the above cases, the demodulation can easily be adjusted from the screen, by comparing the colour of the alternating colour difference signal bars in question with the grey background next to them.

BANDWIDTH

Since the subcarrier frequency is 4.43MHz a certain "moiré" effect in the 3.8MHz and 4.8MHz definition lines is inevitable. Because this subcarrier frequency is nearly half-way between 3.8 and 4.8 MHz, the amplitudes of this interference in the two definition lines sections should be almost equal if the bandwidth characteristic of the chrominance channel is symmetrical. Any asymmetry may easily be detected by comparing the amplitudes of the two interference patterns. A smaller amplitude in the 4.8MHz section generally indicates an asymmetrical chrominance bandpass characteristic.

CHROMINANCE/LUMINANCE DELAY

A difference between the chrominance and luminance delays can easily be demonstrated by means of the colour transient at the bottom of the circle. After a lot of experiments it turned out that a red rectangle on a yellow background was the ideal combination to detect this phenom-



Key to the Philips PM 5544 generator pattern. Compare with photo on previous page. The central horizontal line provides an interlace check.

enon. Because the leading and the trailing edges of this red block correspond to parts of the vertical lines just beneath them, we can get an accurate impression of the difference between chrominance and luminance timing.

BURST-GATING

Two of the far left hand castellations contain a line-alternating (R-Y) signal. If due to wrong location of the burst gating pulse some of this colour information is passed to the reference generator a local colouring will occur in the line-alternating colour difference sections.

MATRIX ADJUSTMENT

The colour bar of this test pattern is the standard 100% saturation 75% contrast type, while the adjacent 250kHz square-wave section also has 75% white amplitude. If the red and the green guns of the picture tube are switched off, only the blue blocks of the colour bar will be visible together with the blue portions of the 250kHz square-wave section. The saturation control of the set should now be set so that the adjacent blue fields have equal intensity. If two other guns are switched off, the corresponding adjacent fields should have the same intensity; otherwise, a readjustment of matrix will be necessary.

(The saturation control does not have any effect on the colour in the 250kHz bars, because these contain luminance information only. The colour they present is artificially created by switching off the guns.)

COLOUR RENDERING

One of the purposes of the colour bars is to facilitate overall assessment of the picture quality and correct setting of the saturation. Although the assessment of colour is a subjective thing, a general impression can be obtained in this way.

The foregoing lists the majority of checks which can be made from this test pattern when radiated by TV station. For those fortunate enough to have direct access to the Philips PM 5544 generator, several additional features are available.

FERNSEH PC-TV 408

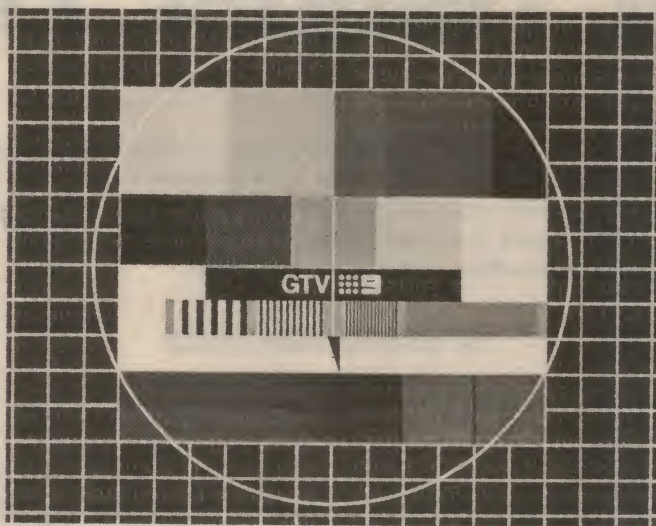
The third pattern is that generated by the Fernseh PC-TV 408 generator. Its functions are described in the accompanying panel, together with a black and white reproduction. A full colour reproduction is shown on our front cover. This pattern is used by a number of Victorian stations, including GTV-9 to whom we are indebted for the colour transparency and the data in the panel.

And that about sums up the three most popular test patterns on the Australian scene at the present time. They are being radiated by the TV stations to assist installation and service technicians. I suggest that it is in our own interest to learn all we can about them, and how to use them. Properly interpreted, they can tell you whether a set is working correctly or not and, if not, the likely area which needs attention.

Good colour and good luck!

GTV9 COLOUR TEST PATTERN

The colour test pattern reproduced in colour on this month's cover, and in black and white in this panel, is that being used by GTV9 and a number of other stations in Victoria. To enable technicians to make the best use of this pattern, GTV9 has distributed a pamphlet describing the functions of the various aspects of the pattern. These are given below.



To assist companies and their technicians installing colour television receivers, GTV Channel 9 will transmit a test pattern at times to be published in program guides. This particular test pattern is primarily technical and provides a comprehensive "off-air" check of a colour receiver performance both on the bench, in the field and in the home.

A description of the technical pattern is provided.

GENERAL

The display consists of a grid of white lines, 19 vertical and 15 horizontal, equally spaced against a half-tone background. The insert rectangle contains the colour information.

CONVERGENCE

Convergence checks, both static and dynamic, make use of the central grid intersection and the grid lines in the outer surround of the picture respectively.

GEOMETRY

Geometry of the picture can be measured against the equally spaced grid lines as well as being assessed with the aid of a white circle which almost encloses the rectangle.

COLOUR BARS

At the top of the rectangle there is a set of colour bars arranged left to right across the picture in the order white, yellow, cyan, green, purple, red, blue and black.

LUMINANCE

The white bar has a value of 75% luminance.

SATURATION

The colours contained in the colour bars have a saturation of 100% but at 75% amplitude.

GREY SCALE

Below the colour bar is a five-step grey scale which rises from black on the left to

white on the right (100%).

STATION IDENTIFICATION

Just under the centre line contained in the box is and identification of GTV Channel 9.

RESOLUTION/FREQUENCY RESPONSE

Below the identification is located a set of frequency bars, 1 Megahertz, 2 Megahertz, 3 Megahertz, and colour sub-carrier at 4.43 Megahertz.

COLOUR SUB-CARRIER

The colour sub-carrier of 4.43 Megahertz appears to the right of the frequency bars described in the above paragraph. The phase of this colour bar is equal to G-Y = 0, and the colour appears as orange.

GHOSTING/REFLECTIONS

Beneath the frequency bars is a white horizontal bar with a black wedge pulse located in the centre. This signal provides a critical test for reflections or ghosting.

RESIDUAL COLOUR CARRIER

The white area of the white horizontal bar mentioned above can be used for the adjustment of the residual colour carrier.

COLOUR PAL DECODING

Correct operation of the receiver decoder and delay line can be checked with the aid of the colour sawtooth signals and the two squares to the right of the sawtooth at the bottom of the rectangle display.

The upper sawtooth appears red, and the lower blue. Each has a maximum value of 75% luminance and is constant for 2 grid spacings and then falls in a linear fashion to black.

The two squares to the immediate right of the sawtooth signals are modulated +V and $\pm U$ with a luminance value of 37.5%. Both the squares should have a grey appearance when the decoding and demodulation are correct.

Keep your cool with the Temper Timer

Whether you're a high-powered executive, a harassed housewife, or just prone to losing your cool, this little gadget should be just what you need. Whenever your pulse rate starts to rise, punch its button. On your behalf it will then count to ten and "blow its top", relieving the tension in a satisfying and harmless way.

by DAVID EDWARDS

In appearance, the Temper Timer is a small box, with a pushbutton on top and an audible signal source on one side. When the switch is pressed, a series of short beeps are emitted, at about pulse rate. These are followed by a continuous tone, which does not stop until the switch is turned off. Counting the action of pressing the switch to start the device as the first bleep, there are nine beeps before the continuous tone starts.

Construction is very simple, and for a small outlay, anyone should be able to build it, providing of course they don't lose their temper in the process! Once completed though, the Temper Timer should help prevent any future loss of control.

The Temper Timer has other uses as well. For instance, it is a useful reinforcement of "If you don't get out of my sight in ten seconds I'll — (deleted expletives)". It can be used as a conversation

piece, as an aid to counting and last but not least, as an interesting way of learning about digital electronics.

The Temper Timer circuit can be considered as three main sections, a clock, a decade counter and the output logic. Turning first to the clock, this consists of a 555 type timer, connected as a free running oscillator with a period of one second and a mark/space ratio of 0.066.

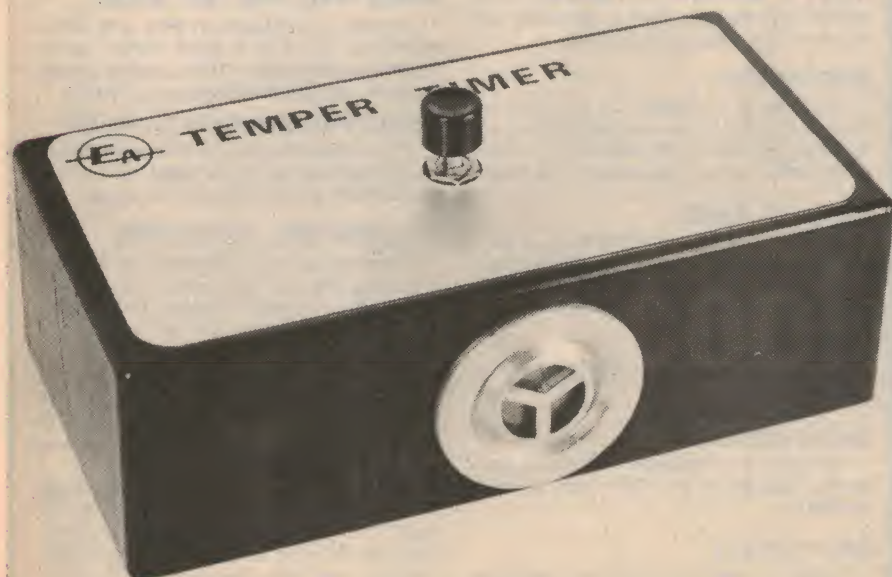
This is all achieved using only a single capacitor and two resistors. The capacitor is initially charged through both the 100k and the 22k resistor. When the voltage at pin 6 reaches two thirds of the supply voltage, an internal flip-flop changes state, and pin 7 is grounded.

This discharges the capacitor through the 22k resistor. When the voltage on pin 2 reaches one third of the supply voltage, the flip-flop is reset to its original state, and the cycle starts again. The output is obtained at pin 3, which is high during

PARTS LIST

1 7490 decade counter
1 555 timer
1 NPN transistor, BC108 or equivalent
1 PNP transistor, BC178 or equivalent
6 Silicon diodes, EM401 or equivalent
1 Mini Sonalert, SC6
1 Case, 127 x 65 x 41 mm
1 Push-on, push-off single pole switch
4 1.5V penlight cells, Eveready 1015 or equivalent
1 Holder for above
1 Piece Veroboard, 0.1in spacing, 12 x 29 holes
RESISTORS
1 x 220 ohm, 1 x 1k, 1 x 4.7k, 1 x 22 k, 2 x 100k
CAPACITORS
2 0.1uF LV polyester
1 0.22uF LV polyester
1 10uF 6VW tantalum
MISCELLANEOUS
Tinned copper wire, solder, hook up wire.

NOTE: resistor wattage ratings and capacitor voltage ratings are those used in our prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.



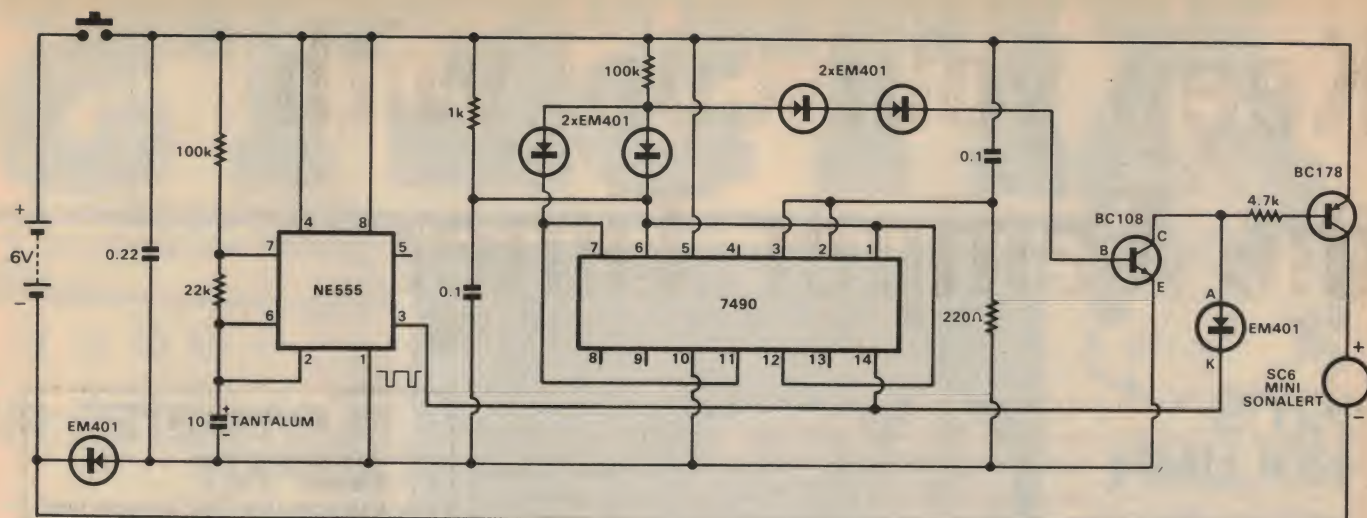
Whenever you feel like "doin yer 'nana," just push the button.

the charge time, and goes low during the discharge time. Since the capacitor must initially charge from zero volts, the first high time is always longer than the following ones.

The decade counter is formed from a 7490 type TTL device. This has facilities for being reset either to BCD "0" or BCD "9". We use both of these reset facilities.

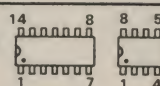
When power is first applied to the circuit, the 0.1uF capacitor in conjunction with the 220 ohm resistor momentarily sends the two reset "0" inputs (pins 2 and 3) high, while at the same time the second 0.1uF capacitor in conjunction with the 1k resistor send pin 6, one of the reset "9" inputs, low. This resets the counter to BCD "0".

Subsequently, input pulses from the 555 timer are applied to pin 14, and this starts the counting action. Note that pin 12 is connected to pin 1, as required to form a BCD counter.



EA TEMPER TIMER

7490, NE555 VIEWED FROM ABOVE



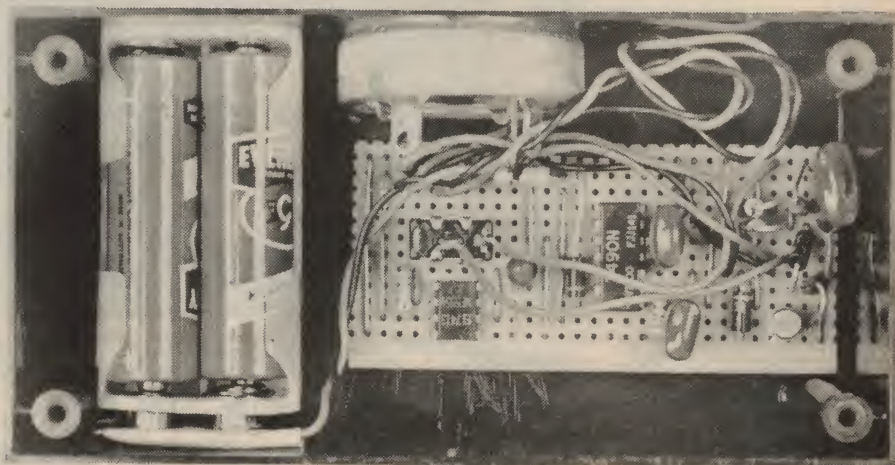
A K

In order to stop the count when it reaches "9", we have used the reset to "9" facility. This is the reason for the connection between pins 11 and 7 and pins 12 and 6. Pins 11 and 12 go high when a count of "9" is reached, and by applying them to the reset-to-"9" inputs, we can force the counter to reset to "9." Since it is already at "9", this causes the count to stop, until the device is retrIGGERED by turning off and then on again.

The remaining section of the Temper Timer is the output logic. The mini-Sonalert, which is used as the output device, is controlled by the PNP transistor. This will turn it on whenever the base resistor is taken low. The bleeps during the count are obtained by connecting this base to the 555 output, via an isolating diode.

A simple AND gate is formed by two diodes in conjunction with a 100k resistor. This is used to sense the "9" count, which occurs at the end of the count. The base of the NPN transistor is held low by the AND gate until the count of "9" is reached. When this occurs, the NPN transistor shorts the base resistor of the PNP transistor to ground, turning on the Sonalert.

The Sonalert then remains on until the power is removed. The total current drain of the complete circuit is about 25mA. A 5V supply is required for the 7490 counter, and a 6V supply for the Sonalert. The 555 timer will operate satisfactorily from any voltage from about 4V to 18V.



This interior view shows the relative positions of the Veroboard assembly, the Sonalert, and the batteries. The Veroboard is held in position by the switch.

We used four penlight cells as a power supply, giving a nominal voltage of 6V. We placed a diode in series with the supply for the logic, to limit the voltage to a safe level. However, the Sonalert is connected directly to the battery, to enable a higher sound level to be obtained.

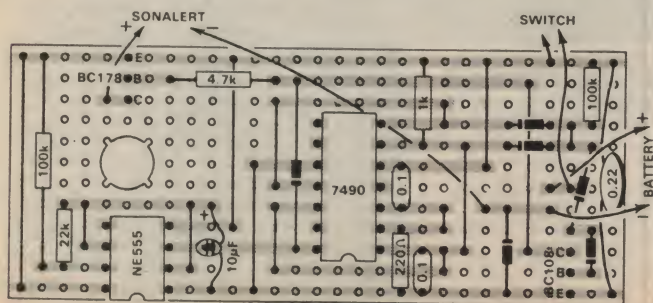
Our prototype was constructed on a small piece of Veroboard, and fitted into a small plastic case. The layout of the Veroboard is as shown in the diagrams. Note the area intentionally left clear of components, so that the switch could be used to hold it to the case. The Sonalert

is a push fit into a suitable sized hole in the side of the box, while the batteries, when fitted into their holder, are also a push fit.

Care is required when soldering the components to the Veroboard, as it is very easy to bridge between the tracks. Do not fit the integrated circuits until last, as they may be damaged by excessive heat. Make sure that all the diodes are fitted with the correct polarity, as well as the tantalum capacitor.

If you have succeeded in restraining your temper during construction, and have actually completed the Temper Timer, now is the time to conduct tests. Carry it around in your pocket, and if at any time you start to get hot under the collar, press the switch and count to ten. At the end of this period, you should be back in control of your temper.

It has been suggested by some that after continued use it may be possible to dispense with the Temper Timer, and count unaided, but this has not been found possible by the ~~riter~~ ~~wrighter~~ ~~other~~ %\$&*c ...



This wiring diagram should make construction a simple process, provided that you don't lose your temper. Follow the diagram in conjunction with the above photograph.

KITSETS



KIT'S KOLUMN

Expense-account called me into his office the other week. He had that sort of look on his face like the ashtay on his Lamborghini was full.

"Close the door and come over here," he said, "this won't take long."

Knowing him, that meant one of two things, and as I already had a drawer full of genuine simulated pearl necklaces made in Hong Kong and 1-day wonder wristwatches, I was about to feign an attack of the vapours when he held up his little golden key. A tingle of excitement ran down my spine and a sigh of relief escaped from somewhere under my nose. Kitsets intelligence section was back in business. (No funny jokes, thank you.)

My mission: unlock the security store with the key. Don my special Mata Hari outfit, complete with chiffon dress, picture hat, and stick-on moustache. (You have to look inconspicuous on a job like this, and these days, everybody but Alfred E. Neuman has a moustache.)

I was to investigate the operations of a certain store which had opened near us. We'd given them the code name of "Mom". Were they really a CIA front? Did they really sell special pre-erased tapes? How much, if any, of their equipment were rejects from pinball machines? I first staked-out the place from the TAB opposite, and seeing no heavies in there (or customers for that matter) I sauntered over, and spent an hour or two looking like a prospective customer. (Which is a bit difficult wearing a Kitsets I.D. badge, but Expense-account won't relax the rule.)

Anyhow, I found out some fascinating things. It certainly appears we've been undercharging for component parts. Mom for instance has 1/2W resistors going for around \$4.95 a pack of 100. Trouble is, we've been charging only \$2 a 100 for 1/2W and 1/4W. Anyhow, Expense-account got all upset and said we'd have to get in line with Mom's prices.

So now we're offering 1/2W and 1/4W resistors at 200 for \$3. (Details at right) It's just for orders postmarked this month. Next month we'll be back to our usual underpriced figures. More about Mom next month. Things like how to convert a 5-cell flashlight to a 2-cell which costs less to operate and shines as bright. Also: how to read assortment packs and find out you could be buying bits salvaged from equipment.

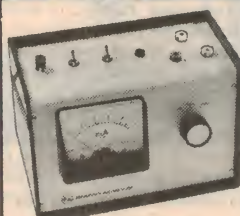
And by the way — you can still buy one of any component part you need at Kitsets. Keep your iron hot,

Kit

COMPLETE SPEAKER KIT

Straight from EA Jan 75. Uses Magnavox 8:30 main driver and 2 x 3TC Magnavox tweeters. 15 ohms. Kit is complete with all necessities including veneered panels, lining, vent, mesh, detailed instructions and diagrams. Each kit: P&P \$5.

\$48



BREAKDOWN VOLTAGE TEST \$33-50

Terrifically handy. Tests bipolar transistors, FETs, diodes (inc. zener types) and other semiconductors. Determines PNP or NPN, checks for silicon or germanium types, measures BVces, BVcer, and BVceo. EA circuit (Jan 75). P&P \$1.50.

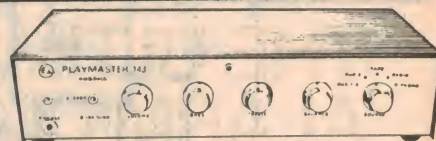


5 STAGE LOGIC PROBE

This is the 1st prizewinner in the Kitsets-Electronics Australia competition. Designed by Ian Robertson, it's an elegant unit, and easy to build, has 7-segment readout. If you're working with logic circuits, it's one kit you should build. P&P \$1. \$13

THE QUESTION: IS COLOUR TV BETTER THAN COLOUR HI-FI?

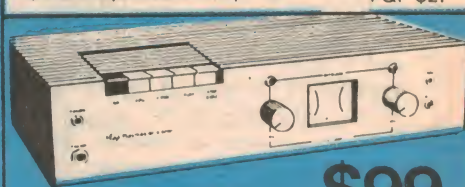
Colour Hi-Fi? Well who said Hi-Fi had to be brown woodgrain, anyway? (Not everybody has brown woodgrain furnishings.) And that's what L&G Hi-Fi equipment is all about... colour. And it looks as great as it sounds. It's pointless showing you here the tuners, amps, turntables, speakers, and so on because we don't have full colour. But you can call into any Kitsets showroom in Australia and see for yourself why we're so sold on L&G. Even just on a performance/price basis it's superb. If there's no way you can make it in to see L&G in the flesh, drop us a line with a long SAE and we'll send you a colour brochure free.



PLAYMASTER 143 AMP KIT

EA's latest (Sep. '74). Virtually a new and advanced version of the Playmaster 136. Includes stereo phone socket and more flexible quad simulation. 16.5 watts RMS per one channel into 8 ohms. \pm 2dB from 20-20kHz. SN ratio better than 60dB. Distortion at typical listening levels 0.4%. Ho-hum. While you know-who expects you to pay \$3 + \$79, what is our price?

\$75
P&P \$2.



BUILD YOUR OWN CASSETTE DECK

\$99

Playmaster 144 as described in EA August and October '74. 80Hz-90kHz. S/N ratio, minus 42dB. Separation better than 30dB. 100Hz-10kHz. 2x200uV mike inputs; line input 120mV into 330k. Complete kit. All you supply is low imp. mike and cassette. P&P: \$4.50.

resistor bonanza 200 for \$3

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TYPE LIST PRICE PRICE EACH FOR MIX OF			
NORMAL PRICE	1-50	50-100	
1S2 \$1.98	\$1.20	\$1.10	
6AL3 \$2.00	\$1.20	\$1.10	
6BL8 \$2.00	\$1.20	\$1.10	
6MB8 \$2.10	\$1.20	\$1.10	
6CM5 \$2.90	\$1.90	\$1.80	
12AV7 \$1.92	\$1.20	\$1.10	

pack/post 50c



Forum

Conducted by Neville Williams

Perspex player covers look well but . . .

One of the favourite resources of early movie stars was the "double take", where the character concerned registers two highly different reactions to a situation — the first casual, the second emotive. Two letters that arrived in quick succession during the past month had just this effect on the writer.

The first came from a reader in the Australian Capital Territory, obviously concerned about the finer points of playing disc records. I quote:

Dear Sir,

In the June '74 edition of "Wireless World", a Mr. M. P. Hide wrote in about electrostatic forces on pickups. He said that he had recently purchased some high-quality disc reproduction equipment, including SME arm and a Shure cartridge.

The deck, he said, utilised a plastic dust cover, and this dust cover was liable to become electro-statically charged. Therefore, if the equipment is used with the dust cover down, there will be a force attracting the arm towards the cover. Since the area of the arm on the stylus side of the pivot is greater than on the counterweight side, there will be a net upward force exerted on the stylus end of the arm.

This, he said, would clearly upset the delicate balancing which provides the tracking force necessary for correct operation of the cartridge. It would also upset the anti-skating to some degree.

After reading this letter, I decided to try his theory out on my equipment. (I own a J. H. Formula 4 tone arm, and a Shure V15 Type III.) As you may know, the J. H. arm is a very low mass arm (effective mass 4 grams), and due to this, it does not have nearly as much metal as other arms. Therefore, I had to reduce the tracking force to get a good reaction. But it did work, and proved to be a very interesting experiment. For those people interested in trying it, this is what you do:

(1) Rest arm on turntable platter, preferably with a stylus guard fitted. (2) Put on dust cover. (3) Stroke the perspex cover; your fingers must be directly over the arm, and you should stroke from pivot towards stylus. If no reaction occurs, try reducing the tracking force. After a small time of stroking, the arm should spring upwards.

Most people clean their records. And

sometimes the cleaner will charge the record. This charge on the record could also cause the arm to react, but to what degree, I do not know.

Mr. Hide also said that he had tried the effects of this electrostatic charge whilst playing the Shure TTR 101 trackability test record. He stated that he incurred distortion when stroking the cover. This further proves his theory.

The only solution that he could render was that of playing the records with the dust cover up or off. But unfortunately, this is rather impractical, and may have rather disastrous effects if you own cats, or any other sort of animal who finds joy in jumping up on turntables, or knocking arms about just because they might move up and down.

R. A. (Mawson, A.C.T.)

As I read down this letter, my first reaction was to view it as the writings of a typical super-enthusiast. Having seen to all the details which concern his "normal" counterpart, the "super" variety sets off in search of second-order effects, which might conceivably prejudice quality of reproduction. Among them is this matter of electrostatic attraction between disc, cover and whatever lays between them.

I say this without seeking to ridicule the correspondent. Pleasure is where you find it and, if some derive pleasure from coping with obscure problems, chasing the last speck of dust, etc, so be it. I myself tend to stop short of such diversions, electing to take the usual measures to ensure good tracking, low record wear and minimal dust fouling — then to settle back to enjoy the program content.

Most times, I play the records with the perspex dust cover lifted clear of the deck for reasons that are practical rather than technical. To operate the cover on its rear hinge would involve the provision of a much wider shelf, which would be both inconvenient and unsightly. In the par-

ticular environment, and with an anti-dust device on the record, dust isn't really a major problem, nor is electrostatic attraction of the cover! It might not suit Mr Hide or R.A. but it suits me.

By the time I'd reached R.A.'s instructions, I was beginning to generate some doubts. Reducing the tracking weight to expose the effect is probably fair enough but a deliberate stroking of the perspex cover in a particular place and direction is going beyond reality. If the problem doesn't show up unless its provoked, you probably don't have a problem!

If I "provoke" my fountain pen sufficiently by rubbing it against my coat, it will attract scraps of paper and lint but, in ordinary everyday use, it remains shiny and uncluttered. I really wonder whether electrostatic forces are much of a problem for the record enthusiast "in ordinary everyday use"?

But having nevertheless concerned himself with such problems, R.A. casually quotes a possible reason for ensuring that the perspex cover is in place during the playing of a record.

Not on account of dust, attracted by an electrostatic charge on the record, or by the vortex created by the spinning table.

But the family cat (or other animal) which likes to disport itself on — or with — the mechanism!

Good grief. Pardon my double take!

R.A. and Mr Hide are getting fussed about subtle electrostatic effects while accepting as a possibility sabotage by the family cat.

I could offer a few suggestions about what to do with such cats but I refrain from expressing them for fear of upsetting the RSPCA. Even so, I don't think it unreasonable to impose an order of domestic discipline which deters animals — or small children for that matter — from tampering with the turntable.

Nudging the needle.

Or dicing with the disc!

Then you can leave the perspex cover raised, if you want to!

The next letter is on an entirely different subject and comes from a reader who had earlier been involved in our discussion of the cascode RF amplifier, "tricky circuits", etc. On this occasion he is up-tight about standing wave effects in TV aerials and he leads off this way:

In column 1 of "Forum" for November, 1974 Neville Williams says "I heard a member of our staff trying to explain to a non-technical friend about standing wave effects in a TV antenna system — presumably responsible for ghosting . . ."

I would be very pleased to have either the staff member or Mr Williams explain it to me.

He then goes on to point out that much was written in the early days of TV about the need for aerials to match feedlines, in order that we should have no standing waves and no ghosts. He says:

Assuming that we are confining ourselves to the reception case only, and not to trans-

mission, then the aerial is the generator, the ribbon is the transmission line, and the receiver is the load.

Whether or not we have a standing wave problem depends on whether the TV receiver is matched to the 300-ohm line, and it does not depend on the match between aerial and line. No amount of mis-match there will cause standing waves.

TV receivers are designed to have a 300-ohm (usually) input, and 300-ohm line is 300-ohm line. Accordingly, a matched condition exists, and no amount of jiggery-pokery at the aerial end will change the fact.

In practice, if the 300-ohm line becomes soaked with rain, or runs too close to gutters or other metal objects, or has sharp bends, etc, which may alter the characteristic impedance of the line, a standing wave condition may result.

Even allowing that standing waves may exist in certain cases, as they certainly do, it is hard to imagine them causing much ghosting when the propagation velocity of 300-ohm flat ribbon approximates 600 to 800 feet per microsecond. Most domestic TV installations have about 50 or 100 feet of feeder at the outside. The ghosts might be displaced 1/10 of an inch apart, or probably less.

I am not pretending that domestic TV transmission lines may not have standing waves from time to time. But I do want to kill once and for all the suggestion that these result from aerial mismatch. Also, even if there are standing waves, I have grave doubts that they will cause much ghosting.

A.R. (Willunga, S.A.)

Well, as we read through A.R.'s letter, we felt that familiar sense of frustration from being blamed for something that we didn't do.

Our main concern in the particular instalment was to indicate the difficulty of explaining electronic fundamentals to a layman in terms that he can readily grasp. To illustrate the kind of comprehension gap that we had in mind, we made passing reference to a conversation about a TV antenna system. That was all. We had certainly not got involved in defining the roles of source, line and load.

To be precise, the conversation to which we referred was between a staff member and a friend who had just spent part of his weekend executing a bright idea. In anticipation of buying a colour receiver, he had cleaned and checked his antenna and installed a new run of 300-ohm ribbon. For good measure, he had installed TV antenna points in various rooms, reticulating the signal as if it had been 240VAC. There were extensions, branches and bends galore.

Not surprisingly, he was faced with a different result from every station from every antenna point — weak signals, strong signals, ghosts. Hence the need to explain why this would be expected, because of standing wave effects resulting from spare bits of ribbon attached to the active feed-

ORGAN PHASE SHIFTER CAN'T POSSIBLY WORK!

Dear Sir,

On page 43 of the October issue of E.A. you show the basic circuit for a phase shifter. Your argument for its operation is that the 180-degree phase difference between collector and emitter will cause a continuous progression of phase rotation due to the change in impedance of the capacitor compared to the resistor.

Surely, as the impedance of the capacitor approaches that of the resistor, the 180-degree out of phase signals will simply cancel each other, leaving no signal at one frequency and an increase of amplitude of the signal as you move up or down from this frequency. The extremes of bass and treble will be out of phase compared with each other but no other angle of phase rotation will be involved.

Vectorially, you have started with two voltage vectors that are of equal magnitude but of opposite directions and, no matter how you add these two vectors, you cannot arrive at a vector different from one or other of the original vectors.

C.A. (Brisbane, QLD.)

line or extending beyond the receiver terminals.

But, because this wasn't the subject of the November Forum, we didn't go into all this detail.

So, by the time we reached the signature on A.R.'s letter, we had generated enough righteous indignation to pen an appropriate disclaimer.

Then we came to the P.S. which provided our second double take:

This letter is not intended as a criticism of the Forum column quoted. The Forum column provided an opportunity to mount my favourite hobby horse!

Good grief — again!

I was reminded of the old silent comedies where Charlie Chaplin and/or his contemporaries were not above booting people solidly in the tail. When the victim turned around, they were greeted with a raised hat and an innocent smile!

Ah well, A.R. has had his fun and made his point, which is basically a valid one in its own context. He has also served to remind us that we could well up-date and re-publish an article on the subject of multiple TV outlets originally featured in our October '59 issue.

October '59! Phew!

In the panel is a letter from a Brisbane reader who has obvious doubts about a phase modulation circuit featured recently.

I can assure C.A. that the circuit does work as claimed. It is by no means original to E.A., the same basic idea being used, for example, in the Schober organ fea-

tured in our July, '74 issue. It was also used in one or two early phase modulated systems of simulated quadrasonic. If further assurance is necessary, we compared input and output of our prototype on an oscilloscope and made sure that the phase rotation effects were maximised in the centre of the musical range.

What C.A. has overlooked is that the capacitor is not just a varying resistance in series with the signal from the collector. If it were, there would indeed be cancellation at one frequency and increasing amplitude to either side of that frequency.

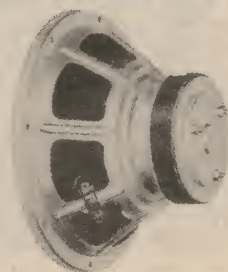
But it doesn't work out that way. In any RC coupling circuit, even the ordinary interstage variety, phase rotation becomes evident across the capacitor as the frequency is reduced and its impedance rises towards and beyond that of the terminating resistor. We are not therefore looking at a simple resistive divider, but one in which one arm of the divider is reactive.

Because of the progressive phase shift across the capacitor in our prototype circuit, there is no way in which the two voltage sources can ever cancel. They merely combine to produce a resultant which is substantially in phase with the input at low frequencies, out of phase at high frequencies, and transitional in between. Actual amplitude of the output signal is substantially constant within the pass band of the stage.

Phase modulation is achieved by varying periodically the resistive portion of the divider, thereby modulating the phase of all the affected frequencies.

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Sine,
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10 Volts out into
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DIGITAL COUNTER
80 MHz, 20 mv sensitivity.
Frequency. Counts per minute.
Period. Totalize.

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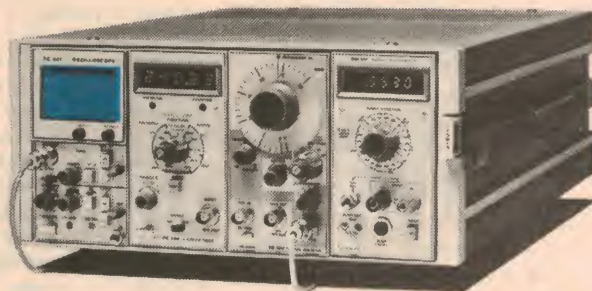
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TX 27

Circuit & Design Ideas

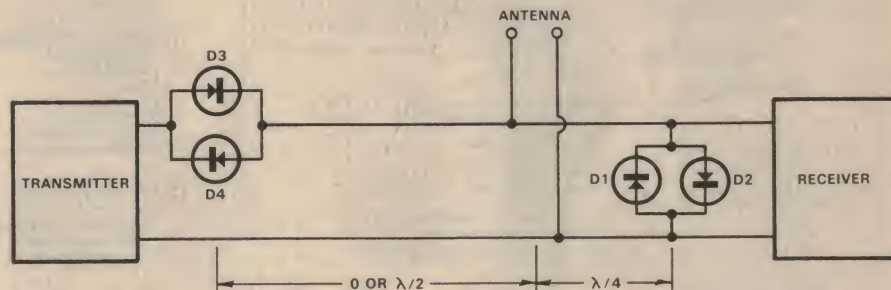
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Passive solid-state antenna switch

A lot of antenna switch schemes have appeared in the past but all used complicated tuned circuits and lots of diodes or vacuum tubes that required high voltage supplies. This circuit uses only two pairs of silicon diodes, one pair (D1 and D2) which effectively shorts the receiver input during transmission, and the other (D3 and D4) which disconnects the transmitter during reception.

Because of the high power from the transmitter, D3 and D4 conduct and the power flows towards the antenna. Likewise, D1 and D2 in the receiving branch also conduct and put a short circuit across the line at the receiver (only 0.6V appears across D1 and D2), thereby protecting the input circuits of the receiver. As the short circuit is a quarter wavelength from the T-junction, the impedance in parallel with the antenna line at the junction is very



high and does not affect the power traveling towards the antenna.

During reception, the impedance at the T-junction looking toward the transmitter is infinite because there is an open circuit half a wavelength away caused by non-conducting D3 and D4. Looking toward the receiver there is a matched line, so

all the power from the antenna goes into the receiver. The diodes are high frequency switching diodes with current ratings depending on the transmitter power. The line is the same as the one used to feed the antenna.

(By Alejandro Lieber, in "Wireless World".)

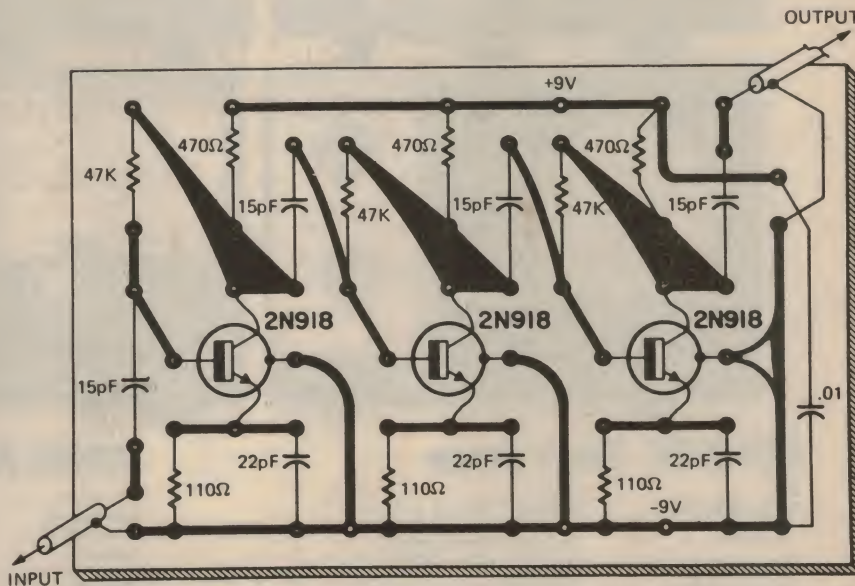
Simple TV booster

Most build-it-yourself TV boosters use L-C circuits that limit tuning to a single channel, or require elaborate procedures for broadbanding the circuits. The booster shown in the diagram is an untuned broadband amplifier (originally from "Television", Paris) covering channels 7 to 13. The gain is 25dB at 180MHz and drops 3dB at 150 and 210MHz. The power supply can be between 4.5 and 12V, although 9V is shown on the diagram.

Parts layout is not critical, but you may want to use the layout as shown. The 75-ohm input and output impedances can be matched to 300-ohm twin lead by baluns. The gain can be controlled by inserting a 500-ohm pot in series with the output emitter resistor.

The parts are assembled on a board approximately 57mm x 89mm. The circuit is easy to duplicate using perforated board and clips or a PC board.

(From "Radio-Electronics".)



Cross-coupled transistors form balanced mixer

The collectors of the two transistors (2N1303) are wired together to share the output load and their bases and emitters are cross-connected. Thus a positive-going carrier wave turns on one transistor while the other is kept in the off position. This produces a positive pulse across the com-

mon collector load. When the phase of the carrier wave is reversed, the two transistors switch conditions, again producing a positive pulse across the common load. In effect frequency doubler action is achieved without a phase-shifting transformer. When a signal is applied to the

input terminal a frequency doubled output also results.

The result is a mixture of frequencies dependent on the ratio of signal levels. The mixed signals that appear across the output load are the upper and lower sidebands of the two input signals—the even

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VT108FET Volt-Ohm-Meter

DC volt meter:
 Range: 0.5 to 1,500 V in 8 ranges.
 Input impedance: 11 M Ω on each range.
 Accuracy: $\pm 3\%$ at full scale

AC volt meter:
 Range (Sine wave voltage): 1.5 to 1,500 V r.m.s. full scale in 7 ranges
 (dB): -15 to +66 dBm
 (Any other voltage): 4.2 to 4,200 Vp-p full scale in 7 ranges
 Input impedance: 1 M Ω
 80 pF at 500 to 1,500 V range
 145 pF at 1.5 to 150 V range
 using (PC-14) probe
 Accuracy: $\pm 5\%$ at full scale
 Freq. response: 15 Hz to 5 MHz $\pm 10\%$
 30 Hz to 2 MHz $\pm 3\%$

Ohm meter
 Range: 0.1 Ω to 1,000 M Ω in 7 ranges.
 Accuracy: $\pm 5\%$ of setting range at scale 0.3 to 3
 $\pm 10\%$ of setting range at scale 0.1 to 10

Memory
 1% scale variation: Approx. 30 sec.

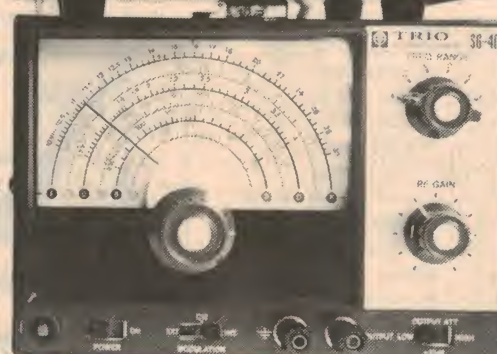
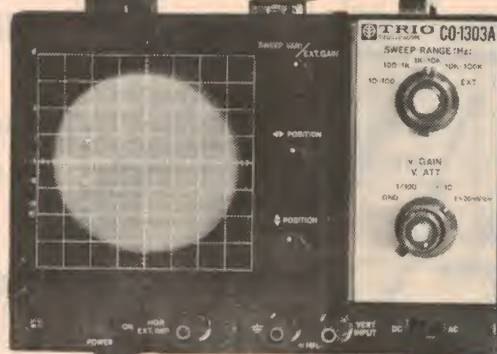
AG202A Audio Generator

Frequency range: 20 Hz to 200 kHz in 4 ranges
 Freq. accuracy: $\pm (3\% + 2 \text{ Hz})$
 Sine wave characteristics:
 Output voltage: 10 V r.m.s. $\pm 10\%$
 Distortion: 0.5% at 50 Hz to 100 kHz
 1% at 20 Hz to 200 kHz

Square wave characteristics:
 Output voltage: 10 Vp-p
 Overshoot: 3%
 Sag: 10% at 20 Hz

Output impedance: 600 Ω
 Output attenuation: HIGH/LOW (40 dB) and variable control
 Drift with line voltage: $\pm 10\%$ variation
 Freq: $\pm 0.5\%$
 Level: $\pm 0.5 \text{ dB}$

External synchronization:
 Synchronization voltage: 1%/V approx.
 Max. input voltage: 3 V r.m.s.
 Input impedance: 10 k Ω



CO1303A 75mm Scope

CRT: C308P1
 Vertical Sensitivity: 20 mV/cm
 Attenuator: 1/1, 1/10, 1/100 plus fine control.
 Bandwidth: DC: DC to 1.5 MHz (-3 dB)
 AC: 2 Hz to 1.5 MHz (-3 dB)
 1 M Ω , 30 pF

Input R and C:
 Max. input voltage: 300 V (DC + AC peak) or 600 V p-p
 Horizontal Sensitivity: 500 mV/cm
 Attenuator: Continuously variable
 Freq. response: DC to 250 kHz
 Input R and C: 1 M Ω , 40 pF
 Sweep Freq: 10 Hz to 100 kHz in 4 ranges
 Synchronization: Internal (—)
 Power requirements: 100/117/230 V AC 50/60 Hz, 15 W.

SG402 R.F. Generator

Freq. range: 100 kHz to 30 MHz in 6 ranges
 Freq. accuracy: $\pm 1\%$
 Output Voltage: 0.1 V r.m.s.
 Attenuator: HIGH/LOW (10:1) and variable control.

Modulation:
 Internal: 400 Hz, 40% mod. degree
 External: Requires 1.5 V r.m.s. for 40% mod. degree
 Power requirements: 100/117/230 V AC 50/60 Hz, 6 W.
 Dimensions: W 186 mm x H 131 mm x D 220 mm
 (W 190 mm x H 154 mm x D 245 mm Max. dimensions)
 Weight: 2.5 kg

• Available at leading electronics stores •

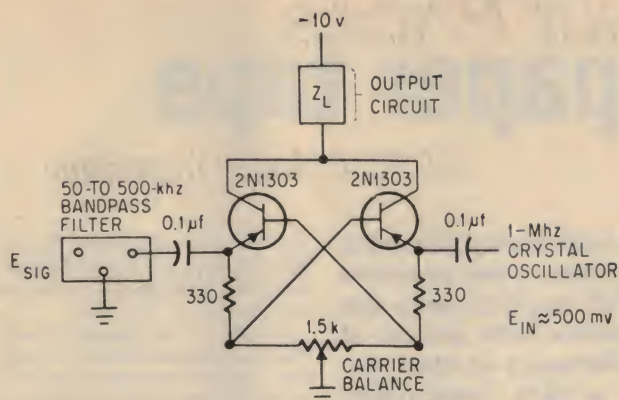
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order harmonics of the input and the carrier. No component at the fundamental frequency appears in the output once the

balance control is adjusted to null the carrier.

The circuit was found to function best

when driven from a low impedance source of approximately 50 ohms. Signals were applied for mixing through a 50kHz to 500kHz bandpass filter. A 1MHz carrier was obtained from a crystal controlled oscillator using a capacitive voltage divider. The ratio of crystal oscillator amplitude to signal amplitude was 10 to 1. The 1MHz oscillator had an amplitude of 600mV. Signals were amplified to produce 60mV at the mixer input.

Because of the inherent wide bandwidth of the mixer input, the input circuits and the crystal oscillator must be shielded. This prevents external mixing of the signals before they are applied to the balanced mixer. The output of the mixer is approximately 600 ohms.

(By Leonard E. Geisler, in "Electronics".)

Editorial Note: It should be possible to replace the two transistors with more modern silicon types. This may necessitate changing some resistor values to suit.

Signal injector in a torch case

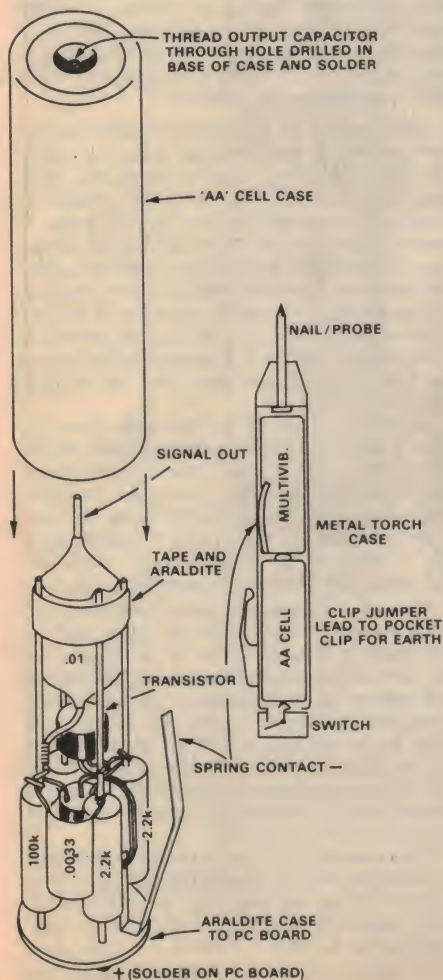
Some time ago I made up a simple multivibrator signal injector as described in "Electronics Australia" in June, 1973. However, I was unable to get a suitable probe housing at the time. On seeing an Eveready "Bijou" torch which uses two type AA cells, I considered that this could

be used to advantage and bought one accordingly.

I rebuilt the injector into an empty type AA dry cell case. The accompanying drawing shows the constructional details. I removed the globe from the torch, filled the holder with epoxy resin and drilled

it for a probe tip (2in nail). The flat head of the nail contacts the top of the housing of the multivibrator, completing the circuit to the probe. A new AA cell is inserted into the torch body, followed by the electronics. The switch built into the torch operates the unit.

(By B. Palamountain, 16 Powlett Street, Sunbury, Victoria 3429.)



Car parking aid idea

While parking my car the other day in a difficult situation between two other cars, the thought came to me that it may be possible to use an old stereo tape head as a metal proximity sensor. The head would be mounted on the bumper bar (front, rear, or both) and one winding would be fed with an audio signal, say 400Hz to 1000Hz, and the other head would feed into an amplifier and speaker inside the car. When the sensing head came close to another bumper bar, presumably some of the signal in one winding would be coupled across to the other winding and so an audio tone would be heard by the driver, the signal increasing in strength as the sensor came closer to the external metal.

I have not tried the idea but someone else may feel inclined to give it a trial.

(By Mr A. Beekman, Ryde, NSW.)

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	4403	73c "
	4440	64c "
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Interfacing EDUC-8 with punched paper tape

Resuming the discussion of peripherals, the author explains here how to go about interfacing surplus paper tape readers and punches to your completed EDUC-8 microcomputer. Full logic circuits are given for typical reader and punch units, together with details of how to modify the circuits for other types. Software is also discussed, and a useful program presented to enable convenient punching of program tapes.

by JAMIESON ROWE

By this stage, quite possibly you have your EDUC-8 microcomputer and its two basic peripherals working, and have been trying your hand at some programs. If so, you've no doubt begun to find it tedious loading each program into the machine via the front panel switch register, and will probably be keen to provide a more convenient and speedy means of achieving the same result.

There are a number of alternatives to the manual method of feeding programs and data into a computer, as you are probably aware, and these generally involve a storage medium such as punched cards or tape, cards with optical marks or magnetic coating, magnetic tape, or a magnetic disc or drum. Each of these has its own combination of advantages and disadvantages, although some are now looked upon less favourably than others in commercial computer applications — where the emphasis tends to be on faster and faster operation.

For the present I am going to deal with only one of these storage media and its handling, although I hope to be able to discuss certain others in later instalments. The medium chosen for this initial foray into the subject is punched paper tape.

Why punched paper tape? Well, it seems to me one that is particularly well suited for storage of the modest-size programs used for an educational microcomputer like EDUC-8. The program tapes are short — at the most they are likely to be about a metre long, including leader and trailer. This makes them easy to handle, and quickly loaded into the machine even with a slow reader unit. At the same time the encoded information they contain is quite accessible, and can easily be "read" by eye after a little practice.

The equipment required to handle punched paper tape is also quite compact, and relatively simple.

There is also a very practical reason for the choice: I believe you are more likely to be able to pick up surplus punched paper tape equipment than any other. There is a lot of this equipment being "pensioned off" from commercial data processing facilities at present, it generally being replaced by key-to-disc systems.

Probably the most suitable sort of punch tape equipment to look out for in this context is the hardware making up what was generally known in the EDP industry as a "keypunch station". These were not connected directly to a computer, but were used merely for off-line preparation of data input tapes from type-writer-style keyboards.

There are two broad types of keypunch station. The simpler type was used for initial tape preparation, and has only a keyboard and tape punch unit together with the necessary power supply and encoding logic. The other type is known as a "verifier station", because it was used to compare the tape produced by the first operator with ostensibly the same information re-entered by a second operator (to try and detect, and correct, operator errors); this type of equipment has not only a keyboard and punch, but a tape reader as well.

The verifier station equipment is the one to aim for, in other words, because this will yield both a paper tape punch and reader, together with the necessary power supply unit to operate them. And for a bonus you'll get a keyboard unit — I hope to describe how to use this also with the computer, later on.

If you're lucky, you may well be able to get hold of a complete verifier station for a few tens of dollars. Quite large numbers have been literally dumped in recent years, which seems almost criminal — particularly since most were made no more than twenty years ago, and cost more than a thousand dollars each!

By the way, it is important to make sure that you get tape equipment designed to take paper tape 2.54mm (1 inch) wide, and that it punches and reads the full 8 bit positions or "levels" possible with this tape. There are other types of equipment around, some of which use the same width tape but only 7 of the bit positions, while others use a narrower tape and either 5 or 6 bit positions. None of these would be

anything like as suitable for interfacing with EDUC-8 as is the 8-level tape equipment, because the instruction and data words for the machine are all of 8 bits.

To help you in checking that a set of equipment is designed for the correct 8-level tape, Fig. 1 shows the main features of this tape. It also shows the standard way of interpreting the bit position, with the three least significant bits on one side of the sprocket hole track, and the remaining five on the other.

Note that the type of encoding used in surplus keypunch gear is not important for our present purpose, as this part of the equipment is not used.

Incidentally, new punched tape equipment is available, if you can afford it. For example McMurdo Australia have a basic tape reader of Italian manufacture, the Ghilmetti type DTR 40K. This operates at up to 40 characters per second, but costs \$270.

The reader and punch unit pictured are both from a verifier station marketed by a big British computer firm, and are fairly typical. Both units were originally made by the Welmec Corporation, of London. The reader unit is designated type R8.1, and the punch unit type S18.8. Both operate from a nominal 120V DC supply, and are capable of working at speeds up to around 10-15 characters per second.

The Welmec R8.1 reader unit uses mechanical sensing of the punched holes, by means of eight small spring-loaded sensing pins. These are attached to a yoke assembly, which is moved upward towards the tape by a pair of heavy-duty solenoids. Each sensing pin is connected by a mechanical linkage to a set of switch contacts, so that the contacts close if their pin meets a hole and is able to travel its full upward stroke. Conversely if a sensing pin does not encounter a hole, it is prevented from moving its full stroke by the tape, and its contacts remain open.

At the top of its stroke, the yoke assembly trips a set of bi-stable switch contacts, which during the upward stroke have been closed. The contacts then latch in the open position, and because they control the current to the main actuator solenoids, this causes the yoke assembly to fall back to its rest position under the influence of gravity and a tension spring.

The yoke assembly has a pawl which engages with a ratchet mounted on the same shaft as the reader's tape sprocket. In falling back to its rest position the yoke assembly thus causes the tape to be incremented to its next row of punched information — after the sensing pins have been withdrawn. Finally, at the bottom of the return stroke, the yoke assembly trips the latching contacts of the bi-stable solenoid control switch, completing the cycle and readying the reader for another.

Note that with this type of reader mechanism, the number actually encoded on the tape is only "read" by the sensing pins, and reflected in their switch contacts, at the top of the stroke. This tends to make interfacing a little more complex than with other types, which generally

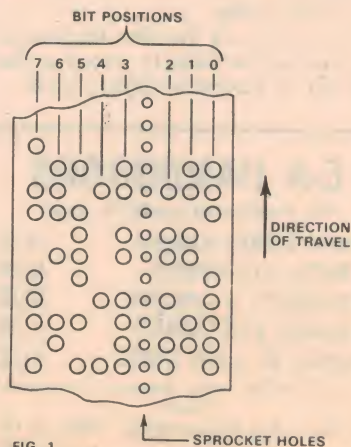
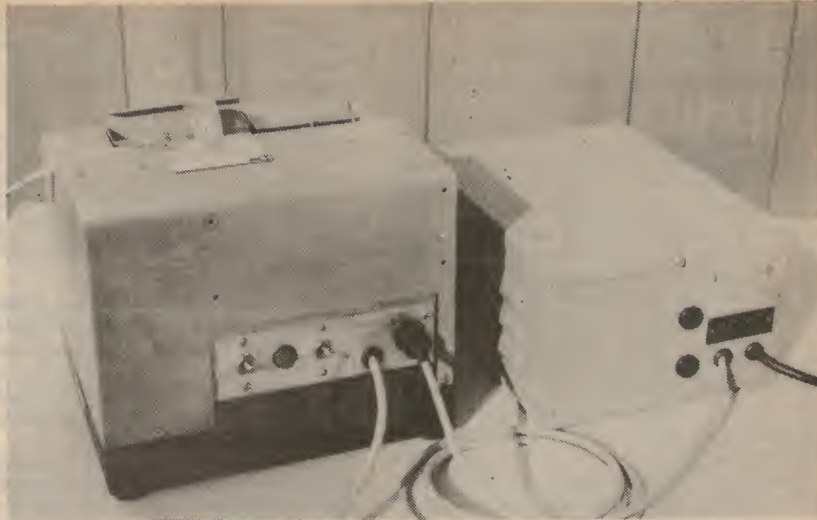


FIG. 1



Above are two views of the Weltec tape punch, as modified by the author, with the power pack visible in the right-hand shot. At right is the companion reader unit, as modified for loading.



tend to read the tape in a static fashion—i.e., whenever the tape is not actually moving.

This means that the simple circuits I have developed for use with the Weltec reader and similar "on the fly" types should work even more reliably with static types, and in that sense they should be suitable for almost any mechanism. On the other hand a static reading mechanism will generally work quite well with even simpler circuits, should you wish to take advantage of this.

Let us now look at the logic circuits required to interface a reader mechanism with our EDUC-8 computer. There are actually two different types of circuit, because there are two distinct functions which a reader may be called upon to perform.

One of the functions is to read input data into the machine, under the control of a program, in the same way data is fed in via the keyboard. This can be the major function of a reader with a large machine, but with a small machine like EDUC-8 it is likely to be of rather less importance than the second function: loading programs.

It is of course possible to load programs in the same way as data is read into the machine, under program control. Here the machine must contain a small program known as a "loader" or "bootstrap", whose sole purpose is to direct the machine in loading in the real programs. The bootstrap program may either be stored in the normal memory of the machine, after having been fed in manually via the console, or alternatively it may be provided by the computer manufacturer in "hard wired" form — i.e., part of the actual wiring, usually an auxiliary read-only memory or ROM.

While a bootstrap program may be used with EDUC-8, this is not a very attractive proposition because the bootstrap would take up valuable memory locations. Even if it took up only 10 or 15 memory locations, this would be a significant and irking proportion of the total 256 available.

Happily this can be avoided, by providing a reader unit itself with the necessary logic "know how" to enable it to load programs automatically. Provision was made in the basic EDUC-8 design to allow this to be done, by means of the external "load address" and "deposit" signals.

Logic circuits will be presented here for both types of tape reader function. They will be presented separately, but could be combined if you so desire. The first, that for program loading, is shown in Fig. 2.

This circuit has been designed to load program tape punched in the following way. First, the tapes have a length of "leader", blank except for the sprocket holes; this allows the tape to be inserted into the reader gate without concern for the actual information. Then at the end of the leader, the start of the information itself is indicated by a single hole punched in the most significant bit position (track 7 in Fig. 1).

The row (or "frame", as they are called) immediately following the start bit is then used to contain the address of the first memory location in which the program is to be stored. After this, the succeeding frames contain the program itself, i.e., the actual instructions in the order they are stored in memory. No further address information is required after giving the first storage address, as the instructions are automatically stored in consecutive locations. The tape is arranged to end a few sprocket holes after the last instruction.

This format is illustrated in Fig. 3. Note that it is usual to cut the start and end of tapes as shown, to make it clear which end is which.

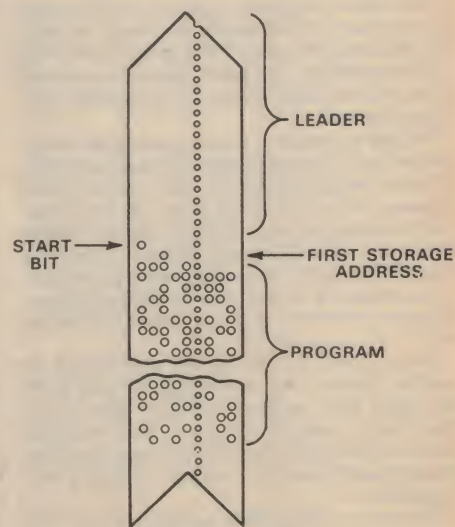


FIG. 3

The heart of the loader logic in Fig. 2 is the two RS flip-flops FFA and FFB, formed by the cross-coupled gates G2-G3 and G4-G5 respectively. These effectively form the "memory" of the loader, and control its operating sequence.

EDUC-8 computer

When power is first applied, both flip-flops are reset by the R-C circuit connected by diodes to the free inputs of G3 and G5. To initiate loading after a tape has been inserted into the reader, the operator merely presses the "load button". This takes the associated input of gate G1 to logic high, and because the other input of G1 will normally also be high (more about this soon), the output of G1 will go low.

The effect of this is to switch FFA to the set state, with the output of G2 high and that of G3 low. Base current thus flows in transistor T2, via the series diode and resistor connected to the output of G3. Accordingly T2 conducts, and applies forward bias to the gate of the C106B SCR, which triggers into conduction. The circuit is thus completed for the reader activator solenoids, and the reader mechanism thus starts operating.

Pulsed by the action of the latching reader switch contacts, which alternatively make and break the solenoid circuit at the bottom and top of the strokes, the reader begins scanning the tape.

A small low-voltage relay RLY A is connected via a 2.7k/10W dropping resistor in parallel with the reader solenoid circuit, such that its current is also alternatively switched by the latching reader switch contacts. A set of changeover contacts on RLY A is then used to generate a feedback logic signal, whose bounce transients are suppressed by the RS flip-flop formed by gates G8 and G9. When the reader is operating, the output of gate G8 is thus a rectangular wave, whose high-to-low transition occurs at the top of the reader yoke's stroke.

This transition is important, because it corresponds to the instant in the reading cycle when the sensing pin contact have been stabilised in their "read" positions. Hence the signal from G8 is used to trigger three cascade-connected monostables (one-shots) D1, D2 and D3. The first monostable D1 is used to generate a pulse about 60 μ s long, immediately following the transition, while D2 and D3 produce two smaller pulses (about 3 μ s) which follow sequentially.

It is the third pulse, from D3, which plays the first part in the loading sequence, via gate G7. The second input of this gate is driven by a PNP transistor, T3, whose base is connected to the reader sensing contacts associated with bit position 7.

During the sensing of the paper tape leader where there are no information holes punched, all of the reader sensing contacts remain open. However, upon the arrival of the "start" frame, the contacts for bit 7 close at the top of the stroke, so that T3 conducts and takes the second input of G7 high. When the pulse from monostable D3 arrives at G7, the gate output therefore goes low, and this causes FFB to be set.

The setting of FFB causes two things to happen. One is that the inputs of gate G16 are taken low, so that its output goes high; this enables gates G17-G24, to open the data paths between the eight sets of reader sensing contacts and the switch register circuits of the computer.

The second thing that happens when FFB sets is that gate G6 now has both inputs taken high, so that its output goes low and that of G12 goes high. This enables gate G14, so that at the top of the reader stroke for the next consecutive frame, the 60 μ s pulse from monostable D1 causes G14 to deliver a LOAD ADDRESS (L) pulse to the computer. Because

the reader sensing contacts will simultaneously be sensing the initial loading address on the tape, this causes the computer to load the address into the PC via the switch register circuit.

This is providing, of course, that all of the switch register switches are in the "up" or 1 position, so that gates G17-G24 in the loader can control the logic levels. This is also necessary for correct depositing, so that when the loader is operated, the SR switches must always be in the up position.

Immediately after the address is loaded, the short pulse from monostable D2 arrives at the input of gate G10. As the second input of this gate is now high, because FFB has been set, the output of G10 is thus driven low briefly. And this in turn resets FFA, so that now only FFB is left in the set state.

Despite the resetting of FFA the reader mechanism continues to operate, because of the second diode and resistor connected from the base of T2 to the output of G5. Gate G6 is disabled, as the output of G2 has now gone low, but G11 is now enabled, because the outputs of G3 and G4 are now both high. This causes the output of G11 to go low, and the output of G13 to go high, enabling gate G15.

As a result, at the top of the next consecutive reader stroke, the 60 μ s pulse from monostable D1 is now passed by G15, to deliver a DEPOSIT (L) pulse to the computer. And this occurs when the reader sensing contacts are registering the first instruction, so that the computer will deposit this instruction as required in the first desired memory location.

This last sequence of events will be repeated for succeeding frames of the tape, depositing each of the instructions in turn. The loading sequence will normally only come to an end when the tape end sensing switch of the reader mechanism registers that the tape has run out. The switch breaks the 120V supply to the solenoids, stopping the mechanism. At the same time it causes the "tape fault" lamp to light, and resets FFB of the loading logic, by turning on transistor T1 via the 120k resistor connecting to the latter's base.

When FFB resets, the output of G16 goes low, disabling gates G17-G24 and thus freeing the switch register circuits for normal operation. At the same time G15 is disabled, so that both the LOAD ADDRESS (L) and DEPOSIT (L) lines are also freed. And as both FFA and FFB are reset, the loader circuit is back to its initial state, ready for loading another program when required.

As you can see, the operation is not particularly complicated, yet the circuit performs the required loading sequence simply and reliably. It contains only eight ICs, of which six are of the low-cost "garden variety": 7400 x 3, and 7401 x 3. The remaining two are 9602 devices, to provide the monostable elements. Together with the ICs there are three low cost transistors, two 2N3638 or similar, and one BC108 or similar; also a C106B or similar SCR, some diodes and a handful of minor components.

Note that because the reader solenoids are highly inductive, they tend to generate a high back-EMF when their current is switched. This is the reason for the R-C circuit across the 120V switch contacts, for the EM408 diode, and for the R-C network across the SCR. The latter is to reduce the rate of rise in anode voltage, which would otherwise cause the SCR to turn on spuriously — and to its detriment.

The 10k pull-up resistors connected to the outputs of gates G17-G24 are effectively in parallel with similar value resistors on the front panel board of the computer itself. I have found them necessary in order to ensure completely reliable operation of the loader with "worst

case" 7401 gates, whose output leakage in the high output state can be as high as 250 μ A.

The additional resistors would not be required if the existing resistors in the machine were reduced from 10k to 4.7k, but this is not easy once the machine is assembled.

The pull-up resistors shown on the outputs of G14 and G15 are for the same purpose. Again it is easier to fit additional resistors in the loader, rather than to change the existing resistors in the machine itself.

Note also — and this is very important — that for correct loader operation, the 0.1 μ F capacitor shown bypassing the external deposit line of the computer should be removed, and replaced by a unit of .001 μ F. This is necessary to prevent faulty operation due to distortion of the loader's DEPOSIT (L) pulses from G15. The easiest way to make the change is to clip the original capacitor from the front panel board, and to wire the new one in at the 16-pin loader socket on the machine's rear panel.

The exact physical form of the loader logic just described will depend upon the reader unit you obtain, and this is left to you. In my case all of the circuitry except the SCR, its R-C circuit and RLY A with its dropping resistor were mounted on one of our "Multi-DIP" boards — the larger size, having space for eight ICs. The other parts just mentioned were mounted on a small square of Veroboard, and both boards mounted inside the original reader case beside the mechanism.

The loader connects to the computer via a multi-way cable, which brings 5V DC to the loader as well as making the signal connections. The cable ends with a 16-way McMurdo plug, mating with the loader socket on the computer rear panel.

High voltage for the loader is derived from the original keypunch power pack, which is a simple transformer and selenium bridge unit with a 1000 μ F reservoir electro and a rating of about 2A continuous. I used a "Bulgin" 3-way panel-mounting plug on the loader, mating with a cord-type socket on the cable from the power pack.

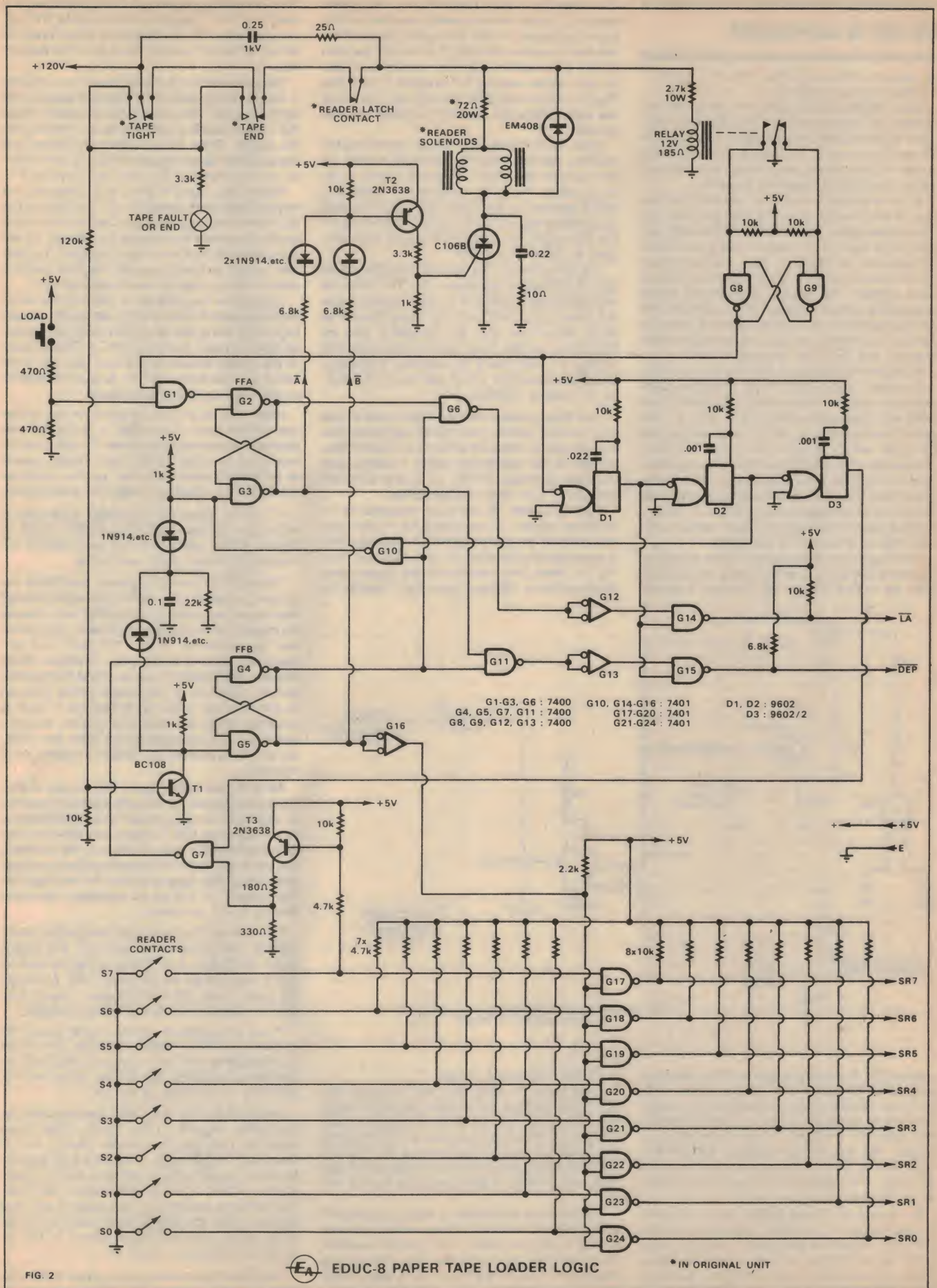
Note that the purpose of G1 in the loader logic circuit is to prevent the load button from setting FFA if the high voltage is not connected, or if the reader gate is open (which opens the tape end switch). When there is no high voltage, the contacts of RLY A revert to their normal positions, so that the output of G8 remains low and prevents G1 from responding to the load button.

This has been done to prevent the reader from suddenly "bursting into life" while the tape gate is being closed, if the load button has accidentally been pressed. Such a sudden start could well damage the tape, by moving it before the gate is properly closed and latched in position.

I should perhaps point out that the circuit of Fig. 2 does not show the 5V supply connections to the various ICs; these are assumed. Also not shown but nevertheless required are the usual bypass capacitors on the 5V line. I used two 0.1 μ F LV polyester capacitors in the loader, one where the 5V enters the board, and the other at the far end.

The other logic circuits given here will assume the same power supply and bypassing provisions.

As mentioned earlier, this loader circuit should be suitable not only for "on the fly" reader mechanisms like the Welme R8.1, but also for those with static reading. However, if the reader mechanism uses a stepping motor or a motor and clutch escapement for tape drive,



EDUC-8 computer

in place of the solenoids, you will need to modify the circuit slightly.

Such reader mechanisms are generally not capable of self-cycling like the Welmec unit. They must usually be triggered into operation for each read cycle, by means of a pulse fed to the driver circuit controlling the stepping motor or clutch escapement solenoid.

As an example of what is required for this type of mechanism, Fig. 4 shows the changes I found necessary to adapt the loader logic for use with a type 1741 reader made by the Tally Corporation of Seattle. This reader has a synchronous motor and clutch escapement drive system, the clutch escapement being actuated by a small solenoid. This is driven with the appropriate length pulses (about 4.5ms) by a power transistor fed by a monostable, both of which are built into the reader unit.

You can see from Fig. 4 that the main change to the logic is the addition of a simple clock oscillator, whose output takes the place of the feedback logic signal from G8 in Fig. 2. The gate formerly used for G8 is now used as an OR gate, which enables the clock oscillator when either FFA or FFB are set. The oscillator circuit is one that the author has used many times before — in fact the same circuit as used for the main clock generator in EDUC-8. It uses one half of a 7413 Schmitt trigger device, with a BC108 or similar NPN transistor.

The trigger pulses required for the monostable and driver circuits of the reader are derived from the output of D1, via the gate formerly

tively slowly to the drive pulse — compared with the 70-odd microseconds required for the logic to operate. In fact the tape typically does not start to move until about 3ms after the start of the drive pulse, and the sensing contacts do not begin moving for another 3 or 4ms. There is thus more than enough time to sense the tape before the sensing contacts are disturbed.

Note that there are other motor-clutch readers, like the Tally model 424, which do not provide the clutch solenoid driver or its monostable. For such readers the remaining 9602 element in the loader logic may be used to generate the required pulse (4.5ms long for the Tally 424), and a suitable power transistor used to drive the solenoid.

The Tally model 424 has either a 48V solenoid, of 220 ohms resistance, or a 24V solenoid with 50 ohms resistance. In either case a series R-C circuit of 0.25uF and 10 ohms should be fitted across the coil, and probably also an EM408 or similar diode as with the solenoids of Fig. 2. With these to suppress transients, the driver transistor could well be a 2N3055, or the smaller 2N3054.

The Tally readers may be fitted with a tape end sensing switch, but this is not connected into the clutch escapement circuit. It is left free, for use in the associated logic: I simply connected it as shown in Fig. 4, so that it merely turns on T1 to reset FFB as before.

Having looked at the logic required for a program loader, let us now turn to the logic required for program-controlled reading. This is considerably simpler, as you can see from Fig. 5. Note that this circuit has again been designed for a Welmec type R8.1 reader, or

This produces a clean H-L transition at the output of G6, triggering monostable D1 and subsequently D2. In this case these produce pulses of length about 10us and 1us respectively.

The pulse from D1 is produced first, and this is fed to the parallel load enable inputs of the buffer register. This causes the information from the reader sensing contacts to be loaded into the buffer. Then D2 produces its pulse, and because the Q-bar output of D2 is connected to the free input of G2, this sets the flag FF.

When the flag FF sets, this removes the forward bias from transistor T1, preventing the SCR from conducting at the end of the return stroke, and hence stopping the reader. At the same time the flag line to the computer is driven low by G3, indicating to the machine that the reader has a character ready for transfer.

As soon as the program in the machine tests the flag line and finds the flag set, it can accordingly shift the contents of the reader buffer out, by feeding clock pulses in via G7. The number in the buffer leaves via G8 and G4, the latter being the line driver and the former an inverter to maintain correct logic polarity.

Note that when the contents of the buffer are shifted out, the buffer is automatically cleared because of the earthed PA, PB and DS inputs on the first 7496. This causes zeroes to be shifted into the buffer as the character is shifted out, clearing it ready for a new cycle.

The final phase of the reader cycle occurs when the computer sends its RESET FLAG (L) signal, which resets the flag and restarts the mechanism ready for a new cycle.

The RESET FLAG (L) signal is also fed to the CL-bar inputs of the buffer ICs even though during normal reading the buffer will already be cleared when the signal arrives. The reason for the connection is that the buffer ICs will generally contain a spurious character when power is first applied, due to either the random turn-on effect or to the reader going through a spontaneous read cycle (before a tape is inserted). With the circuit as shown, the program can be arranged to pre-clear the buffer by an RKF instruction, before reading commences.

As with the loader logic, the circuit of Fig. 5 may be adapted for use with a stepping-motor or motor-clutch type reader. The modifications for a Tally type 1741 reader are shown in Fig. 6. As before the main change is the addition of a clock oscillator which in this case is enabled directly by the output of G1 in the flag FF. The output of the clock oscillator connects directly to D1, as before.

Drive pulses for the clutch escapement monostable and driver are taken from the output of D1, as before, in this case using the second 7413 element as an isolating gate. Although the pulse is only 10us in this case, shorter than with the loader, this is still quite adequate.

If you are going to use the reader logic with a Tally type 424 reader, without the inbuilt monostable and driver, a second 9602 will be needed to generate the 4.5ms pulse, with a 2N3054 or 2N3055 as before.

Incidentally, the two 7496 devices used for the buffer register in the reader logic could easily be replaced by a single device, one of the newer 74165 type. This is an 8-bit parallel to serial register, more or less a mirror image of the 74164 in terms of function. The main logic change required if you want to use this device is that the parallel load pulse will need to be taken from the Q-bar output of D1, as an active low pulse is required.

The final logic circuit to be given is that for a tape punch, shown in Fig. 7. This has been

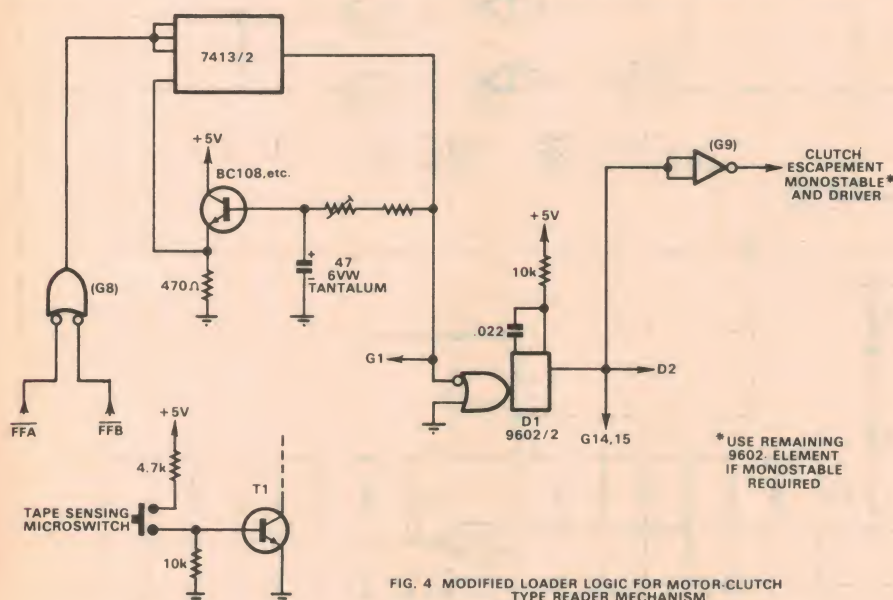


FIG. 4 MODIFIED LOADER LOGIC FOR MOTOR-CLUTCH TYPE READER MECHANISM

used as G9. The 60us pulses from D1 are quite suitable for triggering the escapement monostable, so that the clutch increments the reader sprocket to move the tape one frame forward after each H-L transition in the clock oscillator output. The pot in the oscillator circuit thus becomes the loading rate adjustment, and with the Tally 1741 reader it can be set for speeds up to 50 characters per second.

As the clutch escapement pulse is being derived from D1, it might seem as if loader operation would be disrupted, with the tape being moved at the very time sensing takes place. However, this does not happen, because the reader clutch escapement responds rela-

a similar "on the fly" type.

Here there are only five ICs, of which two are 7496 devices which form the buffer register. The others are a 7437 forming the flag FF (G1-G2) and the line drivers, a 7400 forming the feedback bounce integrating FF (G5-G6) and the clock pulse and data inverters (G7 and G8), and a 9602 dual monostable for D1 and D2.

Operation is as follows. Initially, the flag FF formed by G1 and G2 is reset, with the output of G2 in the low state. This causes transistor T1 to conduct, triggering the SCR and starting the reader. Then at the top of the reader stroke, RLY A is turned off, along with the solenoids.

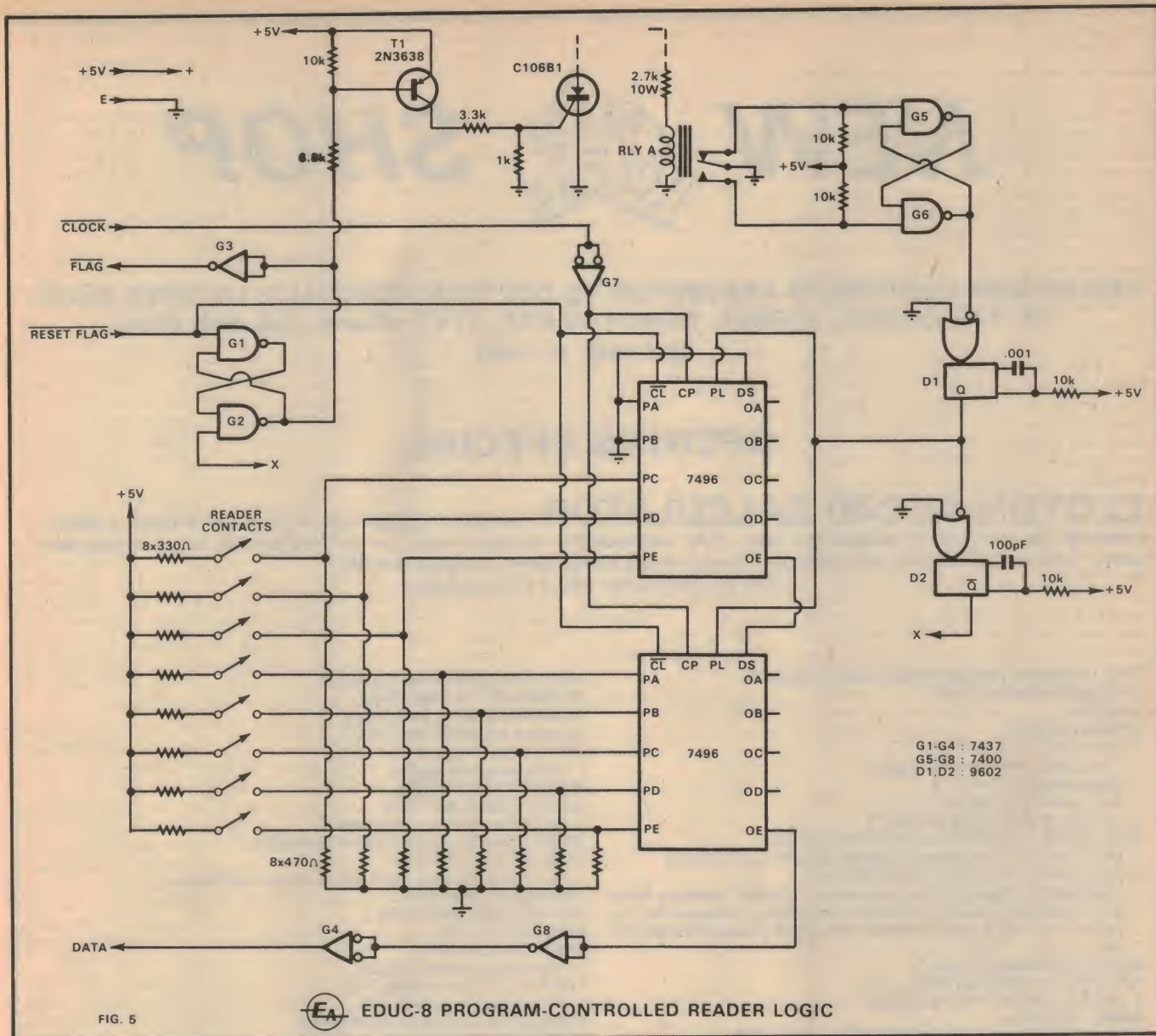


FIG. 5

EDUC-8 PROGRAM-CONTROLLED READER LOGIC

developed for the Welmec-type S18.8 punch, as pictured, although it should be fairly suitable for most surplus punch units.

Mechanically the Welmec punch is not unlike the companion reader, in that the drive is provided by a large solenoid and yoke system which can cycle itself via a bi-stable switch. However in this case the single drive solenoid operates not from the 120V DC supply, but from the 240V AC mains. Its current is therefore switched indirectly, via relay RLY B. A network of RF chokes and series R-C elements is used to suppress the very significant switching transient, with a sealed RFI filter in the mains cord for good measure.

When the yoke of the punch mechanism is pulled up by the solenoid, it is potentially able to force eight hardened punch pins through the tape, which is held between two die plates. But which of the punch pins are actually forced upward depends upon the position of each of eight spacer bars, controlled by the coding solenoids. Only those punch pins whose spacer bars are pulled into position by their coding solenoids actually punch holes, so the pattern of holes punched is controlled by the solenoids.

As you can see from the circuit, the punch logic is not very different from that for the

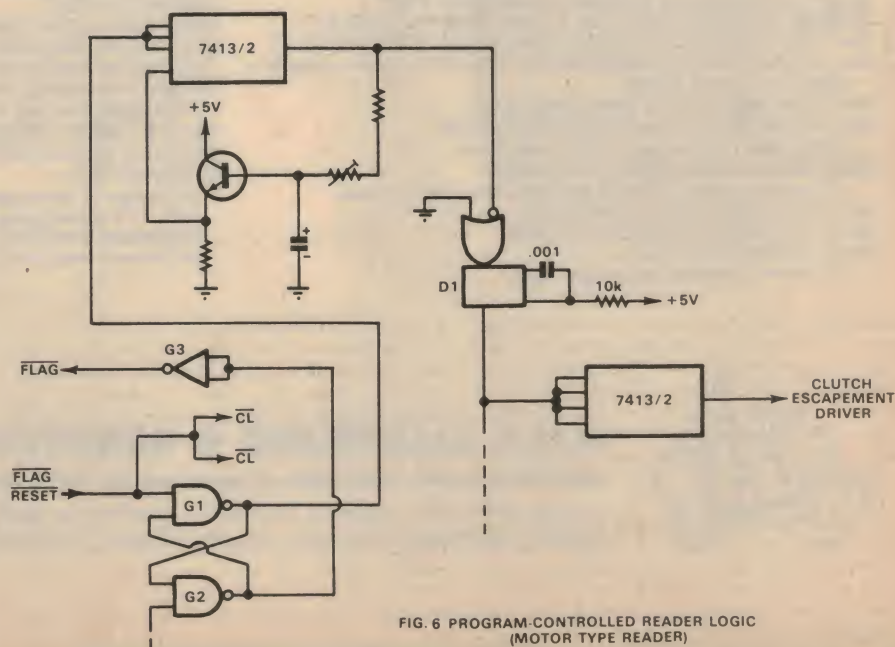


FIG. 6 PROGRAM-CONTROLLED READER LOGIC (MOTOR TYPE READER)

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EDUC-8 computer

program-controlled reader. Relay RLY B controlling the main punch solenoid is controlled by an SCR driver, triggered by transistor T1. This in turn is controlled by gate G5, and also by the manual tape feed button. A second relay RLY A is used as before to provide a feedback logic signal, conditioned by the flip-flop formed by gates G6 and G7. In this case the H-L transition of the feedback signal signifies the end of the punch downward stroke, at the very end of the cycle.

In normal operation, the computer first shifts the character to be punched into the punch's buffer register, which is formed by the 74164 device. It then resets the punch flag FF. This causes a high-to-low transition at the output of G2, which triggers monostable D1.

The output pulse from D1 does two things. One is to enable gates G8-G15, which transfer the character code stored in the buffer register to the coding solenoid drivers. These are transistor-SCR circuits like that used for the main

solenoid relay. Those solenoids corresponding to the buffer bits set to 1 are thus turned on, pulling the appropriate spacer bars into position.

The second effect of the pulse from D1 is to enable gate G5, whose other input is currently held high by the output from G6. The output of G5 thus goes low for the duration of the pulse, causing T1 to trigger the SCR and so activate RLY B and the main punch solenoid. The combination of holes determined by the coding solenoid is then punched, when the punch yoke reaches the top of its stroke.

At the top of the stroke the bi-stable switch disconnects the 120V supply from relay B, so that it turns off and switches off the main solenoid. At the same time the bi-stable switch also connects 120V to RLY A, so that it activates. This causes the flip-flop formed by G6 and G7 to change state. The output of G7 goes high, and remains there until the punch yoke falls to the bottom of its return stroke. Then the bi-stable switch reverses, turning off RLY A and re-applying power to the RLY B circuit ready for the next punch cycle.

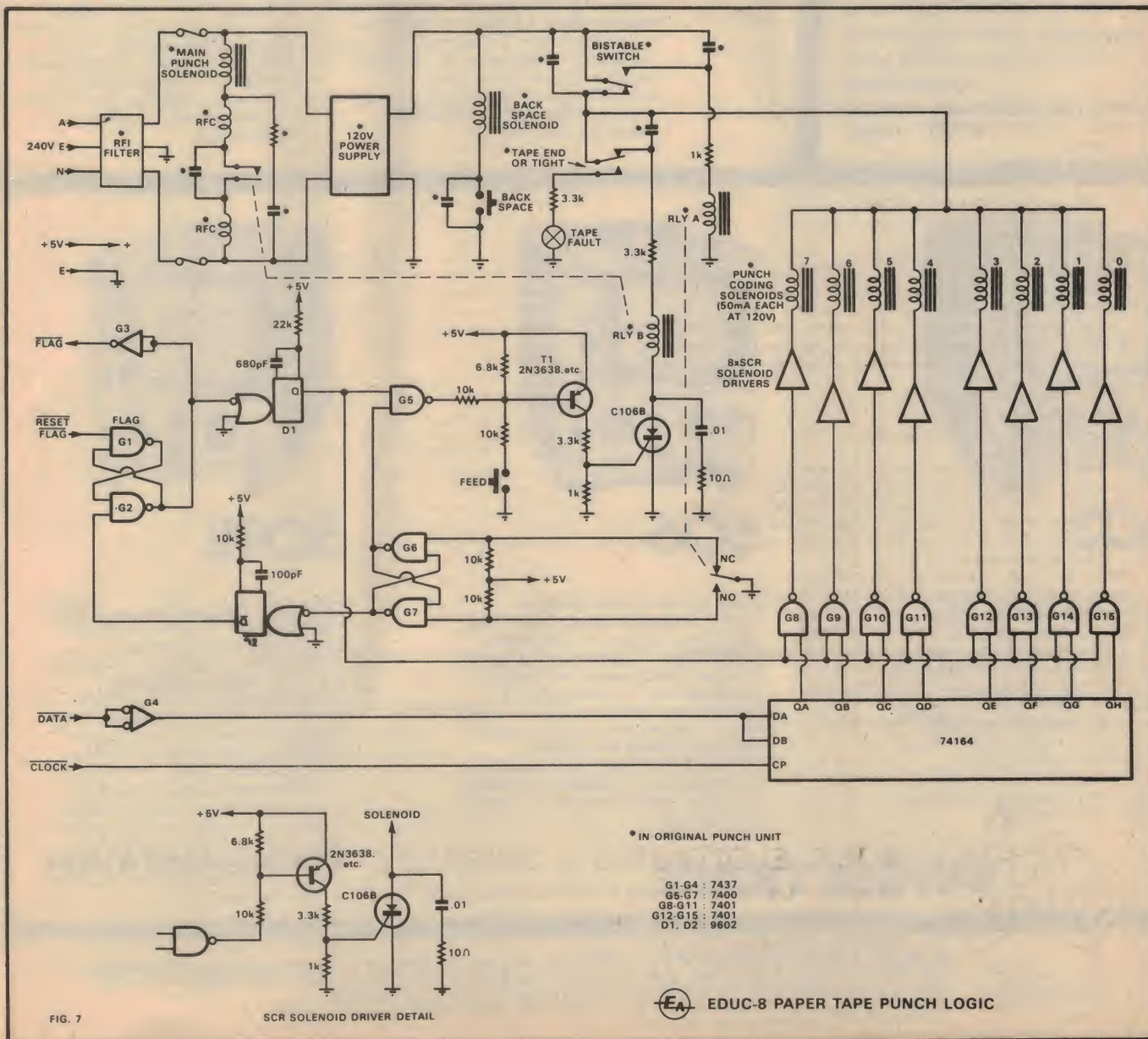
When RLY A turns off, the output of G7 falls to the low state, and this triggers monostable

D2. The output from D2 then sets the flag FF, indicating that punching has been completed.

Note that when the bi-stable switch removes the 120V supply from RLY B at the top of the punch stroke, it also removes the supply from the coding solenoids and their SCR drivers. The coding circuits are thus reset, ready for a new character.

As before, the mechanical form of the punch logic circuitry will depend very largely upon the punch unit you have. With the Welmec unit I was able to wire up all of the low-voltage wiring on a cut-down version of the large Multi-dip board, the two redundant IC positions being cut off to allow the board to be fitted inside the punch case. The eight coding solenoid driver circuits together with the driver for RLY B were wired up on a piece of Veroboard, which was similarly mounted inside the case. RLY A and RLY B are two "3000" type relays, which were already mounted inside the case.

It is not practical to build the power pack into the punch case, and in any case this operates the reader unit as well as the punch. It is left in its original case, with a heavy-duty 5-wire cable connecting it to the punch unit





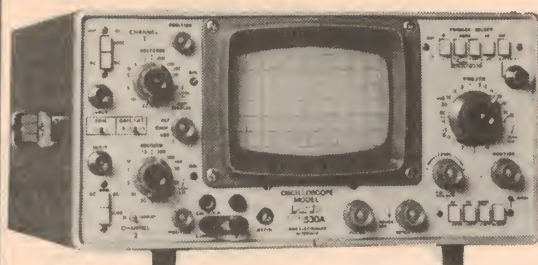
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DUAL TRACE



530A

A compact high performance dual trace oscilloscope featuring a high intensity 6 x 10 cm CRT with an internal graticule. Identical vertical amplifiers with DC to 20MHz bandwidth at 1mV/cm, signal delay line and an isolated ground line for 'in circuit' measurements are complemented by a 40n/sec to 10sec/cm time base and a remarkable DC to 40MHz triggering range. TV line and frame lock, identical X-Y operation, DC coupled Z modulation and an optional AC/DC/rechargeable battery power supply complete the instrument's generous specification.



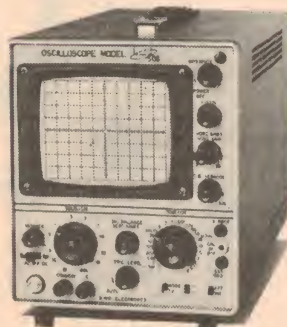
539B

This instrument has achieved wide acceptance in research, education and colour TV servicing. It is exceptionally stable, has a wide DC to 15MHz bandwidth on both channels and is flat within 5% over the video bandwidth. The compatible time base range is from 100n/S to 2sec/cm with rock steady triggering from 2Hz to 15MHz. The active sync separator will lock a TV signal buried in noise and in addition can demodulate AM signals for stable presentation.



503

Designed specifically for student use, this model combines the measuring capabilities of a sophisticated oscilloscope with absolute simplicity and stability of operation. The time base is completely automatic and triggers to any signal producing greater than 1 cm of display. Both vertical amplifier and time base are calibrated and for extra safety the ground line is isolated. The circuit is all silicon solid state.



506

A DC to 15MHz bandwidth at 5mV/cm, a wide range sweep from 40nSec to 10 sec/cm, very stable triggering to > 15MHz and an active TV sync circuit makes the bwd 506 incomparable for laboratory or service use. The sync separator will lock TV waveforms buried in noise and additionally locks to AM signals. To complete the versatility the input has an isolated ground for 'in circuit' measurements to $\pm 400V$ from ground.




509B

One of the finest low cost solid state oscilloscopes available for education, production or servicing applications. It features a large 8 x 10 cm bright crisp display, 10mV sensitivity and DC to 7MHz bandwidth. A time base range from 200nSec to 1sec/cm and superb triggering from < 5Hz to 10MHz. X-Y phase shift is only 1° from DC to 100kHz and calibration is maintained with 5% over a line change of 10% or 10-40°C temp change. With direct reading controls and virtually automatic operation it is the choice of technicians and students around the world.

SINGLE TRACE



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<div>  EDUC-8 PROGRAM </div> <div> BINARY TAPES FROM KEYBOARD OCTAL CODE starts at 006 </div>		
STEP	MNEMONIC	CODE
0	READ, Ø	000
1	TEST, SKF	611
2	JMP TEST	501
3	KRB	616
4	JMP I READ	520
5	BUFF, Ø	000
6	START, RKF	614
7	JMS READ /fetches A	400
10	DCA BUFF	305
11	TAD BUFF	105
12	LDB /display A	626
13	TAD BUFF	105
14	RAL	702
15	RAL	702
16	DCA BUFF	305
17	JMS READ /fetch B	400
20	TAD I BUFD	137
21	RAL	702
22	RAL	702
23	RAL	702
24	DCA I BUFD	337
25	TAD I BUFD	137
26	LDB /display AB	626
27	JMS I READ /fetch C	436
30	TAD I BUFD	137
31	DCA I BUFD	337
32	TAD I BUFD	137
33	LDB /display ABC	626
34	JMP I CONT	535
35	CONT, Ø4Ø*	100
36	RETD, ØØØ*	000
37	BUFD, ØØØ*	005
40	JMS I RETB /fetch command	433
1	SIA /punch?	724
2	JMP SCRB /no, scrub	510
3	CLA /yes, go ahead	710
4	TAD I BUFD /fetch word	134
5	LPB	636
6	CHK, SPF	631
7	JMP CHK	506
10	CLA	710
11	LDB /clears display	626
12	JMP I STAD /back to start	535
13	RETD, ØØØ*	000
14	BUFD, ØØØ*	005
15	STAD, ØØØ*	007
16		
17		

You can use this simple program to punch out program tapes, using the simple input keyboard and display. It occupies only three pages of memory. Note that the constants identified with asterisks are initially in "377" format octal, but are then converted into "737" format to avoid possible confusion. The program starts at location 006.

to provide both 240V AC and 120V DC as required; the fifth wire is earth.

Apart from the power pack, the punch unit was made fully self-contained by transferring into its case the back space button and the "tape fault" lamp. These were originally in the small control console of the keypunch station. The old multi-way connector was removed from the side of the punch case, and replaced with a small aluminium plate. This mounts the back space and manual feed buttons, the tape fault lamp and the 6-way "Bulgin" captive plug used to connect with the power pack cable.

The connection to the computer is made via a length of multi-conductor "TV remote control" cable, as with the simple keyboard and

octal display units. The cable leaves the punch case via a grommated hole, and terminates in a 6-pin DIN plug mating with the output device connectors on the rear panel of EDUC-8.

Since probably the main use of the punch with EDUC-8 will be to prepare program tapes, I have reproduced here a small program which allows you to punch program tapes easily using the simple keyboard unit and the octal display. In effect, the program is a very elementary "assembler", producing binary code from 3-digit octal numbers.

To use the program, connect the keyboard unit to EDUC-8's input device socket number 1, the octal display unit to output device socket number 0, and the tape punch to output device socket number 1. Then turn on both the computer and the punch power supply and, using the manual feed button on the punch, run off a suitable length of leader — say 20cm.

Now load the program into the machine, and enter 006 into the PC register as the starting address. Then set the machine running by pressing the run key. The program is now ready to begin punching a program tape.

First press the "4" key on the keyboard, and after this press the "0" key twice. The octal display should now show "400", and if it does, press the "LF" key. This will cause the punch to encode the start bit on the program tape, in bit position 7. The reason for pressing the keys to give octal 400 is simply that this corresponds to the binary number 10000000, in the "737" format assumed by the encoding program.

A similar process is used to encode the first loading address on the tape, and the actual instructions. Simply use the keys on the keyboard to enter in the octal code for the numbers to be punched, and if the octal display shows that you have made no mistake in keying in the three digits, press the LF key to have the resulting binary number punched.

If, on the other hand, the octal display shows that you have made an error keying in the digits, it is merely necessary to press one of the numeral keys instead of the LF key. This will cause the program to ignore the number keyed in, and clear its buffer ready for a new character. You can then try over again.

This is a very simple little encoding program, and you will no doubt be able to write more pretentious and elaborate ones yourself, if not immediately then later on. However, I have found it quite adequate for preparing program tapes and offer it to you as something to get you started.

Incidentally if you have a program already in the computer's memory, there is a quick way to punch it on tape for future use—providing that it doesn't take up all of memory. This is by using a "dump" program, written to punch out all of the numbers stored in a designated section of memory.

Such a program can also be used for duplicating tapes, if you have only a tape loader. Simply load the tape in, then dump it as many times as required. You may care to try writing such a dump program—it is a worthwhile exercise, and you'll find the program useful.

I hope the foregoing gives you a fairly good idea of the way in which punched paper tape equipment may be interfaced with your computer. As you can see, it is not difficult or unduly complex. If you are able to get hold of the necessary hardware, it is well worth the effort to make up at least the loader and punch units — not only for the exercise, but also because it makes program loading much more convenient!

A discussion of other peripheral devices will follow.

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rocker
approx. ¼ size

J Snap-in
pushbutton

J10 Rocker
approx. ½ size

J4 Paddle
handle
approx. ½ size

J2 Paddle
handle
approx. ½ size

K Locking lever

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momentary
pushbutton

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PC mounting
pushbutton

Right angle
mounting / Flatted
toggle

Right angle
mounting / Short
toggle

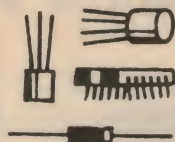
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tear out and keep for easy future reference



What's new in Solid State

Complete one-chip sound IF system

Further to the discussion last month of SGS-ATES' family of ICs for colour TV receivers, some more detailed information has arrived from this firm on one of the ICs concerned. This is the TDA 1190, which as you may remember provides the complete sound channel.

This doesn't mean that the device is merely another limiting amplifier and FM demodulator combination. Together with these traditional functions it also provides an active low-pass filter to reduce quad-detector distortion, a DC volume control facility, and a 4 watt audio amplifier.

All you need is the TDA 1190 with a few minor components, to provide all of the circuitry between video detector and loudspeaker.

The device is in a plastic package of the modified dual-in-line type, with a large heatsink tab emerging from the centre of each side. On each side of both tabs there are three normal pins, with staggered spacing for improved isolation.

The performance of the TDA 1190 is substantially constant from 4.5 to 6MHz, in terms of input frequency, so that it is suitable for any TV system standards as long as they use FM sound. The gain of the IF limiting amplifier is very high, such that limiting of 3dB typically occurs for an IF input of 30 microvolts.

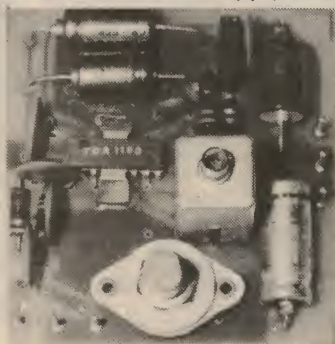
The FM detector is of the familiar IC quad detector type, with an external LC circuit whose Q should be 80 or more. An active low-pass filter is used between the limiting amplifier and the quad detector to reduce distortion. Detector distortion is not quoted as such, but the overall distortion of the device for 50mW out into 16 ohms is quoted as 0.55%.

Following the detector is the DC volume control section. This is interesting, as it merely requires an external variable resistor to ground. The internal circuit appears to be virtually an analog multiplier, so that a DC control voltage adjusted by the external resistor is used to set the amplitude of the audio. The control range is quoted as typically 90dB, with minimum output for maximum resistance.

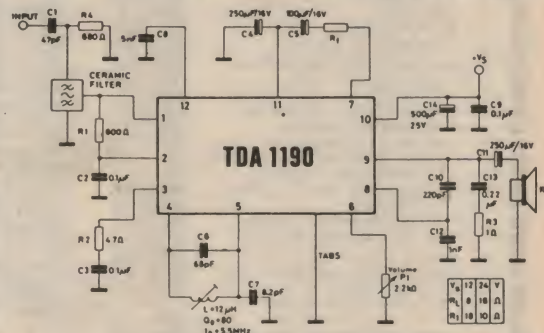
A big advantage of this approach is that it makes remote volume control very easy and straightforward—simply a DC voltage variation. There is no low level audio wiring, with the attendant risk of hum and instability.

The connection between the output of the DC volume control circuit and the input of the audio amplifier section is brought out to a device pin, to allow de-emphasis using an external capacitor. This may be varied, to provide the appropriate time constant.

The audio amplifier section of the device is designed to work into either an 8 or 16 ohm load, the 8-ohm load being used with a 12V supply rail, and the



At left is a complete sound IF and audio module based on the SGS type TDA 1190 device, with its complete circuit shown at right.



16-ohm load with a 24V supply rail. Output power quoted for these two situations is 4.2W and 1.5W respectively, for 10% THD, or 3.4W and 1.35W respectively for 2% THD.

These figures appear to be with the TDA 1190 provided with minimal heat-sink area, consisting of two small areas of copper on the PC board. Higher output can apparently be obtained with a more elaborate heatsink.

The circuit and photograph shown should give you an idea of how the device is normally used.

As noted last month, SGS-ATES are represented in Australia by Warburton Franki Pty Ltd, who have offices in each state.

To pass on to other devices, I note that Hewlett-Packard have recently expanded their range of UHF step-recovery diodes. These should be of considerable interest to radio amateurs, as they can be used to obtain quite respectable output up into the microwave region.

For example one of the HP 5082-0800 series will give an output of 6 watts in the 3 to 5 GHz range, as a frequency doubler. Others will give up to 300mW in the range 10-20GHz.

The devices are not cheap, costing more than \$30 duty free in single quantities. However they don't need any elaborate power supplies, so that this isn't as steep as it may seem at first.

H-P have also just announced the release of some new high efficiency LEDs, in the "T1-3/4" size. Available in yellow and green as well as the familiar red, these use a new method of construction in which the lead on which the chip is mounted has a concave cavity, so that it acts as a tiny reflector.

The chips used for the red LEDs are also designed to have peak output at 626 nanometres, higher than the usual 650-655, and to have a broader peak so that they are easier on the eye.

The typical output of the narrow-angle green and yellow devices is 16 millicandelas, for 20mA and 10mA respectively, with the red device giving a high 24 mcd at 10mA. The prices are quite reasonable.

Further information on both the step-recovery diodes and the LEDs is available

from Hewlett-Packard offices in each state.

Another device which should be of interest to you if you're working with such things as PLLs and frequency synthesisers is a dual voltage-controlled oscillator (VCO) from Texas Instruments, the type SN74S124. It has been around for a while in the US, but hasn't been available here for very long.

Quoted maximum frequency for the two VCO elements in the device is typically 85MHz. The centre frequency is set by a single external component, which may be either a crystal or a capacitor. Both oscillators have two voltage-sensitive inputs, one controlling frequency and the other frequency range. They are also provided with TTL enable inputs, and buffered outputs.

Further information on this and other TI devices is available from their distributors, A. J. Ferguson Pty Ltd. (J.R.)

For further data on devices mentioned above, write on company letterhead to the firms or agents quoted. But devices should be obtained or ordered through your usual parts stockist.

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Notes and Errata.

PLAYMASTER CASSETTE DECK: In the Addendum article in January 1975, it is suggested that the series resistors for the meters should be selected when the deck is fed with an input signal of 0.775V and adjusted for maximum sensitivity. The input should be 120mV, as indicated in the specifications on page 34 of the October 1974 article.

In addition, the text of the Addendum article states that the 1.5k resistor is wired between pins 1 and 12 while the associated capacitor is wired between pins 1 and 3. This is contrary to the circuit diagrams but is immaterial since pin 1 is not an internal connection to the op amp and the components for a series network.

Also, Fig 3 of the Addendum article shows a 1M feedback resistor which should be 1.5M as in the original circuit.

HOMODYNE TUNER (July 1973, File No. 2/TU/36.) The printed wiring pattern on page 35 shows a 0.1uF capacitor as part of the audio filter and a .01uF capacitor as the 12V rail by-pass. These are transposed and should be fitted as shown in the circuit on page 31.

MUSICAL OCTAVE NOTE SYNTHESIZER (May 1974, File No. 1/EM/31): In the circuit diagram on page 45, the pins labelled 6 and 7 of IC7, the SN7493N should be labelled 2 and 3.

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Quiz contest capture system

This simple lamp and buzzer circuit may be treated as an electronic game in its own right, in which contestants can compare their reaction times; or it may be used as an accessory to popular quiz games to determine who has first right to answer a question.

by B. M. BYRNE*

It was inspired by watching the TV quizzes where contestants have to push a button to sound a buzzer and light a lamp to earn the right to answer the question. Some mental gymnastics are necessary as pressing the button to gain the right to answer also carries a penalty if an incorrect answer is given.

On a more dedicated note, the device allows practice, beforehand, by quiz contestants in a TV show. This can really hot up the competition.

The circuit provides the facility to sound the buzzer, and to both light a lamp for the first button pusher, and to remove the capability of the other two buttons to actuate their respective lamps. Thus the quizmaster knows to whom the question is to be addressed.

Electrically, there are three similar circuits — each of one transistor (Tr1, 2, 3), and associated resistors, with a 50mA, 6V lamp in each respective collector circuit. All three transistors are NPN silicon general purpose types, fed from a common positive supply rail. This rail in turn is supplied via a 33 ohm resistor from 9V battery.

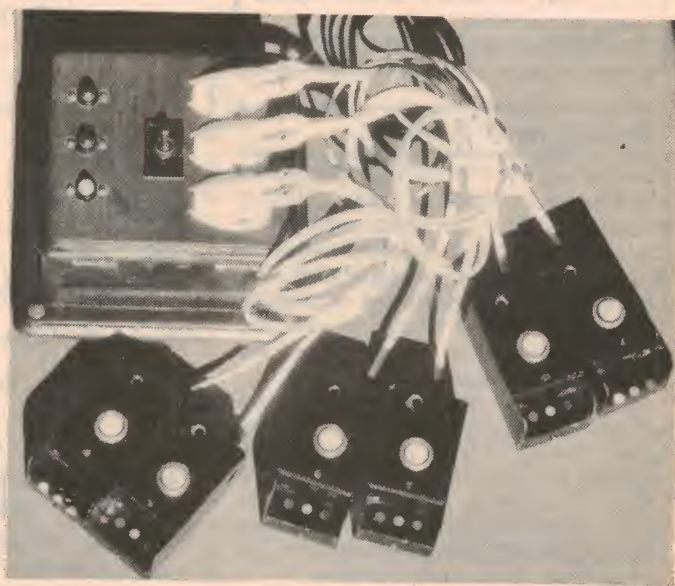
When any one transistor conducts, 50mA flows through this resistor producing about 1.7V across it. This voltage is applied to the emitter/base circuit of a PNP transistor (Tr4) through a protective 220 ohm resistor. This 220 ohm resistor guards against untoward connections and happenings in the buzzer, pushbutton or lamp circuits.

The 1.7V turns on TR4, which is normally off. Its collector is connected to the buzzer, thence to negative. A 470uF 16V electrolytic is fitted across the buzzer to absorb the buzzer surges, which could cause sufficient battery voltage disturbance to affect the other three stages. The capacitor also reduces buzzer voltage spikes which could damage Tr4.

All three transistors (Tr1, 2, 3) are held normally off by a 1K emitter/base resistor

for each. Now one (say Tr1) may be switched on by that contestant's pushbutton, which connects the base to a source of positive voltage. For each transistor, the source is a voltage divider of two 470 ohm resistors, across the collectors of the other two transistors. The control power is fed in each case through a 4.7V or 5.1V zener diode from the divider points to the pushbutton concerned.

The complete system. Each circuit is fitted with a pair of push buttons so that three teams each of two contestants can compete. Antenna plugs and sockets are used to connect the buttons to the box.



As Tr1 conducts, its collector drops to about 1 volt positive, while the collector rail, and hence the collectors of the other two, drop by 1.7V, as previously explained, to 7.3V positive. Under these conditions the voltage available to the other two pushbuttons is only $7.3 + 1$ (No. 1 collector) $\times 0.5$ (voltage divider of 2×470 ohms) = about 4.1 volts. However the 4.7V or 5.1V zeners in the respective pushbutton circuits will not conduct at this figure, so both Nos. 2 and 3 circuits are inoperative.

This condition is set up virtually instantaneously, being in the conduction time—of some nanoseconds—of Tr1 (or Tr3 or Tr2). Thus, the aspect of a dead heat by

the button pushers, with a reaction time of several hundred milliseconds, is of little more than academic interest. As it happens, a true dead heat would favour the circuit with the fastest transistor turn-on time, but it is worth considering that the margin is less than the time delay in hearing the quizmaster's voice, if the contestants are seated so much as one inch more distant than each other from him.

It is necessary to use good zeners, and not "specials", (with high loss currents), as this will indeed give one contestant an advantage. In this case switch-on will be achieved under any conditions, which will also extinguish an earlier set-up of one of the others.

The buzzer may be any unit that will work in the 4 to 6V range, but should not be less than about 25 ohms. This is to

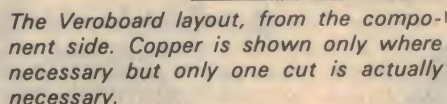
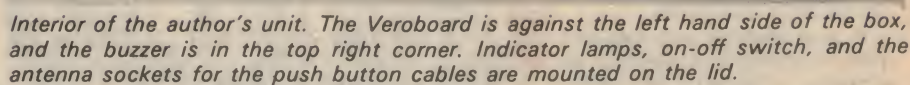
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This project is one contributed to our recent Kitsets-EA Competition. As such, it has not been through our laboratory and should not be regarded as a regular "Electronics Australia" project. We will therefore not be in a position to answer postal queries about its operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributor's name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

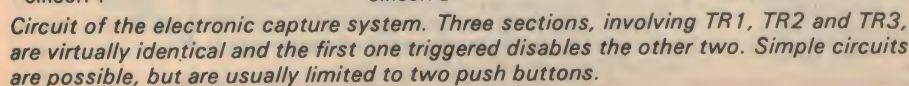
* 118 Central Avenue, Indooroopilly, Queensland, 4068

Layout is not critical. The circuit proper is best wired on a piece of veroboard. The writer used a 2¼in length, cut from a 4¼in wide veroboard, having 21 perforated conductor strips. The 2¼in length provided 11 holes, which proved adequate. The diagram shows the layout adopted. Only one cut is needed in one copper strip, as shown. About 10 to 12 square inches of board are required.

- 1 Box, Jabel LPC or similar
- 1 piece of Vereboard, 4" in wide, 2' in long (21 strips)
- 3 NPN transistors, BC108 or similar
- 1 PNP transistor, 2N3645 or similar
- 3 4.7V or 5.1V zener diodes, BZX79, C4V7, or similar
- 1 470uF electrolytic capacitor
- 3 1k resistors
- 6 470 ohm resistors
- 1 220 ohm resistor
- 1 33 ohm resistor
- 1 2.7 ohm resistor (*W)
- 3 6V, 50mA lamps complete with bezels
- 1 9V battery, 276-P or similar
- 1 Battery plug to suit
- 3 Push buttons
- 1 Buzzer, 6V, 25 ohms or higher. (See text)
- 10yds 10s.010 insulated hookup wire. (See text re colours)
- 12 4BA x 1in machine screws with nuts



The three bezels can be mounted on the lid of the box or, if desired, can be extended by hookup wire to be associated with the pushbutton concerned. All leads leaving the box need anchoring inside the box. Plug and sockets are another, tidier,



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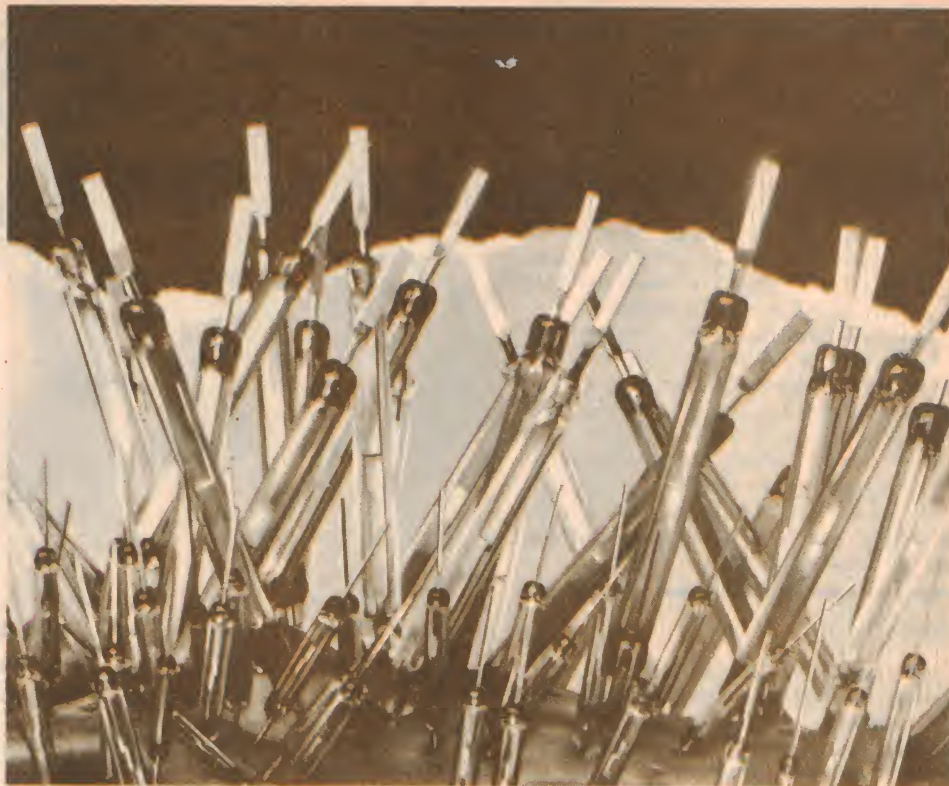
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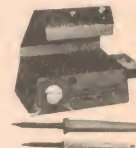
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CAPTURE SYSTEM

way of terminating the pushbutton leads. The writer used antenna plugs and sockets. (See photograph). The on/off switch mounts on the box lid.

The 9V battery may be fitted inside the box, as noted above, or externally if it is desired to avoid having to open the box at intervals. The ideal battery is a No. 765 but, as this type is almost extinct, a smaller type—276-P—is shown in the parts list. A sizeable battery is necessary to prevent buzzer surges having an unwanted coupling on the lamp seize circuits.

Three pushbuttons are required, and can be mounted on small wood blocks, like older electric switch blocks, or on small folded aluminium boxes, made from scraps of metal. The connecting leads must be anchored at the button end to avoid strain on the button terminals.

Well, that's about the lot! If it is made with reasonably good components, and does not work, it just has to be a faulty connection, or a flat battery.

The writer made the original available to the local school to practice for a TV quiz show. The result? A request for two more! It has also proved an entertaining device in the teenager area in the family. There is no known solution though, for the main problem — wear and tear on parents!



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Classical Recordings

Reviewed by Julian Russell



Penderecki—"instant eloquence"

PENDERECKI — Utrenja. Oratorio in two parts, the Entombment and the Resurrection of Christ. The Soloists and Chorus with the Symphony Orchestra of the National Philharmonie of Warsaw. Philips stereo 6700 065. Two discs.

Shaw once remarked about English concert audiences — I quote from memory — that the mere mention of the word oratorio causes a suspension of judgement. And when one recalls the monstrosities in this form that flourished in Victorian days, one is inclined to endorse his sweeping statement. I am starting my review with this quotation because all over the Continent, including Iron Curtain countries, Penderecki has been hailed as one of the finest composers of religious music since J. S. Bach. And this reputation has followed him to England. When I first heard, and reviewed his St. Luke Passion, I was struck by what I called Penderecki's "instant eloquence". I found it a shattering experience — an historical or narrative — rather than a religious one. I still find it exciting though repeated playing dulls rather than sharpens enjoyment. It yields little more at subsequent hearings than it did at the first.

In writing this I mean in no way to disparage Penderecki. Any composer who can give me the thrill I enjoyed at my first hearing of the St. Luke has my perpetual gratitude. On the other hand repeated playing of Bach's B Minor Mass will, if you are industrious enough to seek them, reveal hidden subtleties at subsequent performances. But I find that listening to a complete performance more than an effort — even a bore. It reminds me of what Lytton Strachey once wrote in another context. I quote: "From perhaps some personal disability I suffer agonies of boredom — and admiration — during most of the work. The whole thing is wonderfully well done but it's impossible to stop the attention wandering." St. Luke, after many repetitions is never a bore though I am far from claiming that Penderecki is a greater composer than Bach. To do so, at any rate at this stage of his career, would be idiotic.

Utrenja has much in common with St. Luke; it is in fact a sequel. In two parts, the first tells of the Entombment of Christ, the second of his Resurrection. The two parts, composed about a year apart, were

both commissioned by Radio Cologne. The one complements and fulfills the other. They complete the Easter Passion from Good Friday through Sunday to Easter Monday — from grief to exultation. And though Penderecki realises instantly the emotions of the different occasions, it is the vividness of his narrative powers that continues to impress one. And it is here that I ask myself if this is further evidence of the truth of Shaw's statement — that oratorios have the power to suspend the critical judgement of the majority of their audiences? Perhaps, more importantly, do they substitute attendance at an oratorio for other other devotional duties? I am inclined to think so. But whatever the reason Penderecki is the first avant garde composer since Berg to be greatly appreciated and enjoyed by vast au-

diences. His acclaim is very nearly universal, quite the reverse of the coterie admiration awarded so many of his contemporaries. This is not to say that Utrenja will please ears attuned to such mellifluous liturgical works as the Verdi Requiem or the Schubert Masses. Here is no La Boheme of the church. Many to whom contemporary music is a matter of harsh dissonances will find little relief in Utrenja. But no one can successfully challenge the intensity of its truth. Even if you do not want to repeat the undeniable impact of the first acquaintance you owe yourself the experience of this "instant eloquence."

Penderecki claims not to have used any established church music in his score and I regret that there is not the space here to go into his researches into the liturgy of the Eastern Church, mostly in Bulgaria. If you wish to explore this subject further you will find it admirably covered in Malcolm Rayment's perceptive notes in the handsome brochure that accompanies the boxed set.

The recording has vast presence, perhaps a little on the big side for anywhere but a very large music room. And even in a big room one is made to feel how magnificently better it would sound in a spacious cathedral. The soloists taken all round deal resourcefully with their difficult parts supported by a splendid combination of instruments under the unfailing discipline of conductor Andrzej Markowski.

Ireland—Orchestral Masterworks, Vols. 1 & 2

IRELAND — Orchestral Masterworks Volumes 1 and 2. World Record Club Stereo S/4397/8.

John Ireland was a very English composer and for that reason alone will appeal to only few Italian and Central European ears. Just why this should be so is not very clear. English music is in no way inferior to that written by composers of other nationalities this century. True the English do not cultivate the "Le Gloire" attitude of the French, the studious analytical interest of the Germans, nor the adoration of the voice of the Italians. There has always been a great public for music in England and during at least one period it was regarded unquestionably as the foremost musical country in the world. Yet the old prejudice remains despite the enormous amount of music coming from so many different sources being offered live, broadcast and televised in all the earth's developed countries. My advice is therefore that before deciding on these two discs, if you are not of Anglo-Saxon origin, you listen to them attentively.

This present issue comprises all the orchestral work Ireland composed with the exception of the Piano Concerto. Now while I think Ireland was at his best when writing for the piano, there is much to be enjoyed in these orchestral pieces. Although he was born near Manchester, he lived most of his life in London and

became an honorary Cockney, so to speak. His London Overture, which is the first time on disc one, is thematically interesting, the scoring expert and colourful and the combination of the two often moving. Not unexpectedly there is an occasional reference to Elgar, another honorary Londoner. The Epic March offers all one might expect of a concert march as opposed to a military one. However the martial spirit receives ample attentions and, in the middle section, a very English sounding, flowing melody breathes a different kind of patriotism. The March, by the way, was commissioned as a spirit raiser by the BBC during World War 2.

Holy Boy, a carol of the Nativity, was originally written in 1913 for piano solo but won such a hold on public affection that Ireland made from it the haunting version for string orchestra that Boult plays so sensitively here.

The slow introduction to the Concertino Pastorale suggests nothing of the rustic scene. Rather it reflects as atmosphere of black-out gloom. It was composed in 1939 a few weeks before the outbreak of war. But the black mood soon gives way to a lovely legato melody of truly pastoral flavour. The Concertino's second movement, a threnody, is my favourite on this disc. It is soul searching music, unremotely romantic in its subjective meditation, yet it has truly classical proportions.

A stately, shapely achievement. A very lively Toccato makes a fitting brisk end to the little work.

The Minuet and Elegy from the four movements of the Downland Suite complete Disc 1. The first sounds almost innocent though the writing hides a very resourceful technique. The Elegy is another of Ireland's lyrical, musing movements.

Ireland was very sensitive to the sense of *deja vu*, that feeling of having been in a strange place before, and often, when he visited ancient ruins he identified himself in imagination with the place and its prehistoric inhabitants. A case in point is the *Forgotten Rite* on Disc 2 generally thought to have been inspired by ruins on one of the Channel Islands. Briefly it evokes the silence of a prehistoric place of worship and has nothing in common with the other *Bite* — that of Stravinsky. Indeed there are, surprisingly, a few bars strongly reminiscent of Wagner.

Another prehistoric site inspired the symphonic rhapsody *Maldun* — the ancient fortifications near Dorchester. The music suggests the struggles of its defenders to repel its many invaders before the Romans finally overcame them and occupied the fort. A curious example of *deja vu* in Ireland's case is that he pieced together the scene some 15 years before a noted archaeologist made much the same discoveries when he excavated the site. As in the *Rite*, Ireland again succeeds in creating an unmistakable air of prehistoric mystery and the struggles for survival of its primitive people. And in this portion you have just the barest hint of Stravinsky's *Rite of Spring*.

Legend for Piano and Orchestra, was also inspired by ancient relics, in this case a prehistoric fort and flint mines. Later, in medieval times, it was a leper colony with a church nearby. But for other strange sources of inspiration of this work I must refer you to Julian Herbage's excellent sleeve notes. He received the manuscript as a wedding gift from the composer of the Overture "Satyricon" to his and his wife's understandable bewilderment. This notice would not be complete without high praise for Eric Parkin's impressive playing of the piano part in Legend, the thoroughly idiomatic playing of the LPO under Boult and the unvarying excellence of the engineering of the two records.

★ ★ ★

SCHUMANN — Davidsbundler Dances. Four Night Pieces. Claudio Arrau (piano). Philips Stereo 6500 178.

It is difficult to imagine these pieces as dances in the accepted sense of the word. They are for the most part 18 short items revealing varying aspects of the composer's character. All illustrate his special genius in writing for the piano — spreading his music all over the keyboard. Arrau follows Schumann's markings scrupulously without, however, quite achieving

the composer's characteristic impetuosity. Arrau's playing sounds a little too studied though his effortless technique articulates every note.

Early in his creative career Schumann wrote many of these delightful musical collections — *Papillons*, *Carnaval* and others. Although I have mentioned some slight divergencies by Arrau from what I would describe as Schumann style — and I might add that I have the greatest possible admiration for this great pianist — I can still recommend this performance for its many other merits, especially as on the reverse side you will have a rare treat — the seldom heard *Four Night Pieces*. These are far from lighthearted. Indeed they may well be said to express the composer's premonitions of his early tragic mental breakdown and death. There is no — or at any rate very little — ebullience here. Even over the fast passages there hangs an anything but happy air. Arrau plays all four with the greatest imaginable sensitivity.

★ ★ ★

GRIEG — Piano Concerto in A Minor. Clifford Curzon and the London Symphony Orchestra conducted by Oivin Fjeldstad.

FRANCK — Symphonic Variations.

LITOLFF — Scherzo from Concerto Symphonique No. 4. Curzon with the London Philharmonic Orchestra conducted by Sir Adrian Boult. World Record Club. Stereo S/2802.

Debussy once described Grieg's music as — I again quote from memory — snow wrapped in pink paper. The remark reflected the general opinion of Grieg's music in those days, an opinion which I still held by many musicians. They tend to trivialise all that Grieg wrote and perhaps the least fortunate victim is the Piano Concerto. The first time I ever heard a really "big" reading of the work was some years ago when the late Julius Katchen and Charles Mackerras played it in the Sydney Town Hall. I am afraid that I was only one among contemporary critics to give it an enthusiastic notice, others dismissed it as "out of style." Now Clifford Curzon treats it in much the same manner in a reissued recording he made way back in 1960. But though his, and the orchestra's interpretation is big, everything is in scale. Parts are strongly rhythmic, the lyrical passages are never drooled over but preserve an innocent freshness. I can't say that Curzon adds a new dimension to the concerto. That dimension is already there to be appreciated by those with the perception of Curzon and his conductor, Oivin Fjeldstad, as it was to Katchen and Mackerras. Curzon's technique is cream smooth and the scale of the performance gives excellent chances for the preparation of really massive climaxes.

The recording has a great deal of reverberation by modern standards though the good balance between soloist and orchestra does much to help one to ignore this

except in those spots where a chord sounds like it's left hanging in mid air.

Franck's *Symphonic Variations* start solemnly — I nearly wrote cautiously. Curzon seems to be restraining himself for some reason. The form is always shapely but emotional intensity is missing. Some passages are taken so solemnly that I felt I wanted to urge him to get on with it. This time the conductor is Boult who, fine accompanist that he is, adjusts his mood accordingly without protest or nudging. At all times he wins much rich sound from the LSO. Boult does however seem to feel happier when Curzon starts to make more assertive statements. Altogether it is a curious performance, sometimes almost feminine in its delicacy, at others masculine enough but a trifle too thoughtful. Although there are nowadays many alternative recorded performances I prefer, you many well like this one. You will find plenty to admire in Curzon's immaculate technique though to me even the last allegro sounds too calculated.

The *Litolf Scherzo* has always been a favourite of mine and this to me is an ideal performance. Its quicksilver bit of prestissimo playing flashes past without a falter. One moment it ripples; sometimes it is strongly accented.

It is a dazzling exhibition of brilliance and elegance. I can safely say it is my favourite performance of this piece of musical fizz.

★ ★ ★

VLADIMIR HOROWITZ COLLECTION — Vol. 1 The Young Horowitz. Vol. 2, Chopin 1. RCA Victor Mono VVM1-7013/4.

When one expresses astonishment at the brilliant techniques of the best of our younger contemporary pianists, one is inclined to forget just how fine was that of this wunderkind of the 1920s. Some of the recordings on the first disc go back as far as 1928 reprocessed skillfully to remove most of the surface noise on the old shellacs — 78s of course. In those days Horowitz belonged to the school of far-stretched rubatos especially in the Chopin pieces. Yet strangely, on Disc, in the slow movement of the B Flat Minor Sonata (the famous Funeral March) where Horowitz might have well been expected to indulge this characteristic to the limit, you find instead not only a steady tempo moving irresistibly forward but a reading of considerable majesty.

The two discs comprise a collection of works by many composers — Chopin, of course, Scarlatti, Paganini-Liszt, Debussy, Dohanyi, Tchaikovsky, and unlike the rest, a bore of a work by Kabalevsky. The playing is still something to marvel at despite its out-of-date idiosyncracies. Horowitz' complete control of his instrument is never once at fault. For those who today enjoy the fashionable nostalgia for the shows of yesteryear, these two records should have an irresistible appeal.



Variety Fare

Reviews of other recordings

Devotional Records

THE CRUCIFIXION — John Stainer. Soloists with the Leeds Philharmonic Choir, and Eric Chadwick, organ, conducted by Herbert Bardgett. Stereo, World Record Club. S/4618.

While the devotional works of the great composers are more suited to concert halls than churches, the reverse is true of Stainer's "Crucifixion". Its suitability for church performance is underlined by the fact that no orchestra is used and only two soloists, tenor and bass. This fact, plus the lack of difficult passages, probably accounts for its repeated performance on Good Fridays in many English parish churches where in some it is an annual tradition.

Part of its popularity may be attributed to the congregation being required to participate in five hymns.

In fact, any reasonably competent choir can give a respectable performance. Here, with a group of professionals taking part, the work's many excellent musical features are brought to the fore. Two very well known singers sing the solos — Alexander Young, tenor, and Donald Bell, bass.

In summary, then, very much a devotional work, rather than a purely musical one, but nevertheless one that contains much musical enjoyment. (H.A.T.)

★ ★ ★

CURLEW RIVER — a parable for church performance, music by Benjamin Britten. Stereo, World record Club. S/5716.

For the listener with more advanced tastes, it is releases like this which make membership of World Record Club worthwhile. I believe it to be the only recording of this work available.

The work is based on an old Japanese Noe play, concerning a mad woman searching for her infant, only to learn from a ferryman that her child is dead. The action in Britten's interpretation is transferred directly to mediaeval England, and related in Christian terms, with the music based on plain chant. The opening scene has a choir of monks chanting the anthem "Te lucis ante terminum", and the composer tells us in a program note that "from it the whole work may be said to have grown".

I am sorry that space does not allow me to deal in greater detail with the circumstances of the work, but purchasers of this issue will find detailed notes as well as a full libretto supplied. Recorded under the personal supervision of the composer, and with the composer's long-time colleague and friend Peter Pears singing the role of the Mad Woman (for reasons explained in the notes), this must be regarded as a definitive performance. The Decca recording, produced by John Culshaw, is first rate. (H.A.T.)

★ ★ ★

BECAUSE HE LIVES. Gene Gaither. Stereo cassette, Word WC-8627. Also available on disc. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

"Is that Jim Reeves?" asked someone in the room when I put this cassette on. The question is indicative of the content but, personally, Gene Gaither would get my vote for this highly listenable program. With instrumental and vocal backing he produces a very smooth, gently rhythmic sound, C&W style. The titles: Because He Lives — If That Isn't Love — I'll Fly Away — The Family Of God — There Is A River

— Sheltered In The Arms Of God — Through It All — When The Roll Is Called Up Yonder — On The Wings Of A Dove — Something Beautiful.

An imported cassette the sound is clean, though lacking slightly in sparkle. But unless you're a hifi fanatic, you'll overlook this slight criticism in the enjoyment of the music (W.N.W.)

★ ★ ★

THE BLACKWOOD BROTHERS ON TOUR. Stereo, RCA Camden ACLI-0428.

A reissue but completely re-mastered, this is a recording of a broadcast by the Blackwood Brothers, of Memphis Tennessee, from Long Beach California. And a rollicking performance it is, with the compere, the Blackwood brothers, the rhythm pianist, and the audience all contributing to the decibels. Perhaps I should have mentioned also the auditorium reverberation, or was it bounce from the P.A. system? Anyhow, an uproarious time was had by all as the Blackwoods bounced their way through ten Gospel songs:

Crossing Chilly Jordan — Bell Of Joy Keep Ringing — Because Of The Love Of The Lord For Me — Happy People — When I Stand With God — Because Of Him — Only Believe Him — Dear Jesus, Abide With Me — Pablo — The Old Country Church.

Technically, the sound is a trifle resonant at the top end but easily its most obvious characteristic is in the extreme stereo separation, with the artists on opposite sides of the room and the crowd in between. On headphones, the mono-plus-mono-plus-stereo effect is obvious indeed.

Will you like it? Depends on your mood and whether you happen to feel like a high pressure Gospel rollick! (W.N.W.)

Instrumental, Vocal and Humour

SPUTNIKS FOR ORCHESTRA. The Royal Philharmonic Orchestra, conducted by Stanley Black. Stereo, World Record Club. S/5277.

The "sputniks" comprise a collection of popular Russian light classics: Night on the Bare Mountain (Moussorgsky) — In the Steppes of Central Asia (Borodin) — Flight of the Bumble Bee (Rimsky-Korsakov) — Marche Slav (Tchaikowsky) — Nocturne (Borodin) — Comedians' Galop (Kabalevsky).

This program has undeniable appeal, and although Stanley Black may not compare with the leading conductors who have recorded these works, the Royal Philharmonic could play this kind of material with their eyes shut and still make it sound

good. So if the program appeals you will find little to complain about. Originally a Decca Phase Four recording, the sound quality is up to standard. (H.A.T.)

★ ★ ★

A MAN & HIS GUITAR. Juan Marquez, guitar, with orchestra. Stereo, Hispavox (Festival) L25040.

If guitar with orchestra playing hit tunes by such groups as The Beatles; Crosby, Stills & Nash; The Monkees; Blood, Sweat & Tears . . . and so on . . . is to your taste, this offering by a young Spanish artist may interest you. The tunes include: Bad Moon Rising — A Hard Day's Night — Never My Love — Groovin' — Marrakesh Express — Spinning Wheel — Holiday — ten tracks in all. Presented with a pleasant beat, the disc should appeal to the late teenage to young adult market. (H.A.T.)

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.) and Norman Marks (N.J.M.).

THE SYNTHESIZER SOUND MACHINE 2. The Fantastic Pikes, Sonic stereo 9063.

Too many records employing the Moog synthesizer end up sounding like they used a cheap chord organ but this has not occurred. The Fantastic Pikes, as they call themselves, are an instrumental group with a style quite similar to the well-known "Ventures" except that the FP's add the synthesizer. Their arrangements are aurally interesting and have a driving beat. Record quality, as far as one can judge with anything using a Moog, appears to be good.

Twelve tunes are Mooged: Ooh Baby — Angie — Capriccio Italien — High Noon — Apache — America — 48 Crash — Whisky In The Jar — Once Upon A Time In The West — If I Were A Rich Man — Raindrops Keep Falling On My Head — Turkischer March. (L.D.S.)

★ ★ ★

VICTOR SILVESTER and his orchestra. Vol. 2. Stereo, Astor Gold Star series GGS-1437.

Having first broadcast on the BBC in 1937, Victor Silvester still has them swirling on the ballroom floor in '75. This is all strict tempo dance music but he so varies the sound and intersperses tempos that he'll have you toe tapping as you listen through the twelve tracks: Gentle On My Mind (quickstep) — Joanna (fox-trot) — Sugar, Sugar (moden beat) — Skiel O' The Pipes (Gay Gordons) — Mexican Shuffle (jive) — Knees Up Mother Brown — Abanda (March) — The Coffee Song (samba) — South Of The Border (rumba) — Yeh! Yeh! (twist) — Something Is Happening (cha cha cha) — The Shadow Waltz (waltz).

That's quite a helping I'm sure you'll agree. The quality is good and it would make a pretty good party sound, whether you dance to it or not. (W.N.W.)

★ ★ ★

THE STARS OF SHOWCASE Volume 2. The Hector Crawford Orchestra. Stereo, L & Y Records (Festival) L-25176.

Those who enjoyed the 1974 "Showcase" series, telecast on the Channel 9 network, will have a natural interest in this album featuring some of the vocalists and instrumentalists who appeared on the show. Perhaps I should quote the items and artists for your guidance: Anne (Gordon Boyd) — Praeludium (Jane Peters) — Some Enchanted Evening (Dale Stewart) — Valse Brillante (Mark Leslie) — Medley (Valgray Two) — Mendelssohn Violin Concerto (William-Hennessy) — He Aint Heavy (Ross Hamblin-Taylor) — This Could Be The Start (Inner Circle) — Dawn In Darkness (Mark Holden) — Never, Never, (Markeeta Little Wolf) — Music Of The Day (Peter Combe) — Shaft (Orchestra).

Having personally seen quite a few of

the items on air, I found the album something of a let-down. The balance was not the best in places but mainly, I think, it was the old story: what comes across well with the visual is often disappointing without it. Some of the items are okay, mind you, but the impact overall is mediocre. A pity..(W W)

★ ★ ★

THE BEST OF THE ROGER WAGNER CHORALE. Stereo, World Record Club. S/5289.

The Roger Wagner Chorale was, to my mind, superior to other similar groups. For one thing, their arrangements were always very good, but probably more important, they had very good soloists, such as baritone, Earl Wrightson, whose rendering of "The Wide Missouri" here is fine singing of a beautiful melody; also soprano Salli Terri, and contralto Marilyn Horne, who has gone on to greater things since these tracks were recorded. Some tracks here are old enough to be "reprocessed stereo" and the youngest must be near to 15 years old. Accordingly allowances must be made for sound quality, but the singing is first class.

The titles: Torna a Sorriento — Wide Missouri — On Top of Old Smokey — Were You There — Deep River — Aura Lee — Lord's Prayer — Song from "Moulin Rouge" — He's Gone Away — Beautiful Dreamer — Ave Maria (Bach-Gounod) — Nobody Knows the Trouble — O, Bury Me Not — Aloha Oe. (H.A.T.)

SONNY & CHER/GREATEST HITS.

Sonny and Cher Bono. MCA stereo MAPS 7257.

While Sonny Bono may have considerable talents as a television and record producer, he just cannot sing — he sounds like an alley cat having its neck wrung. He should leave the singing to Cher. To be fair, the record quality is not the best and makes even Cher sound on the rough side. Still, the record should still sell well, especially as the popular Sonny & Cher show is currently on television.

Tracks are: All I Ever Need Is You — When You Say Love — You Better Sit Down Kids — Crystal Clear/Muddy Waters — I Got You Babe — A Cowboy's Work Is Never Done — United We Stand — The Beat Goes On — What Now My Love — Mama Was A Rock And Roll Singer. (L.D.S.)

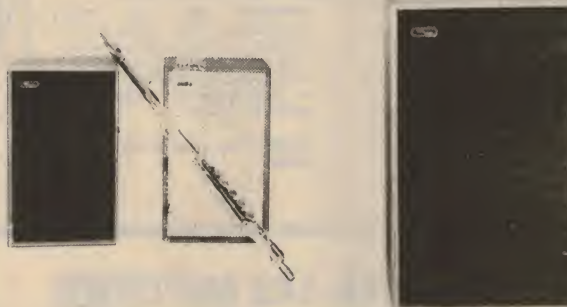
★ ★ ★

SERENADE. Ron Goodwin and his Orchestra. Parlophone recording. World Record Club release WRC S/2459.

A delightful recording in the best 'easy-listening' tradition would be my description of this disc. The twelve titles include: Sunrise Serenade — Elizabethan Serenade — Clair de Lune — Prairie Serenade — India — Elizabeth and Essex — Serenade To Double Scotch.

Ron Goodwin is well known for his music for radio, films and television and this disc should only enhance his reputation. The quality is excellent. (N.J.M.)

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VARIETY FARE

GOLDEN GUITARS. Stereo, Polydor 2371 415.

Bright, tuneful, pleasant are all appropriate words to describe this new Polydor album. Appropriate to the title, guitars play a prominent part in the music making but there is a full complement of other instruments and even a vocal chorus to present a dozen sure-fire favourites: Boriquito — Those Were The Days — Brazil — Guantanamera — Winchester Cathedral — Dark Eyes — Azzurro — Love Story — Delicado — Moon River — Hora Staccato — Danny Boy.

Endorsed Polydor "hifi-stereo festival", the album lives up to expectations in regard to quality and you can enjoy it at full volume. A good one. (W.N.W.).

★ ★ ★

SING A FAVOURITE SONG. Volume 3. Des O'Connor, with orchestra conducted by Jack Parnell. Stereo, Astor ACT-2531.

A vocalist must have solid popular appeal to justify a volume 3 of the same basic theme. And, of course, Des O'Connor is well known with a relaxed, easy-on-the-ear style that you can listen to or singalong with, according to the whim of the moment.

For good measure, Jack Parnell's orchestra provides just the right backing for: Sometimes I'm Happy — She — My Sentimental Friend — What'll I Do? — Carolina In The Morning — The Old Fashioned Way — Smile, Smile, Smile — Tie A Yellow Ribbon — A Certain Smile — What A Wonderful World — Nellie Dean — The Most Beautiful Girl — If You Were The Only Girl — One Of Those Songs.

Something old, something new, something borrowed, something blue: it still holds good (W.N.W.).

★ ★ ★

RUSTIC WEDDING SYMPHONY — Carl Goldmark. The Utah Symphony Orchestra conducted by Maurice Abravanel. Stereo, World Record Club. S/5339.

Abravanel and the Utah Symphony made a number of fine recordings for Vanguard in the 1960's, of which this is one. The symphony has so many of the qualities which constitute musical greatness that one wonders why more is not heard of this composer's work. During his lifetime Goldmark, who came from a poor background, suffered much from the gibes of those two social and musical snobs, the critics Hanslick and Speidel, and this undoubtedly hindered his career. It is hard to understand what impedes his fame today.

Some people still maintain that this is not really a symphony at all, as the first movement is a set of variations. For my part, I find it entirely enjoyable music. (H.A.T.).

★ ★ ★

POPULAR VERSE OF EARLY AUSTRALIA. Peter O'Shaughnessy. Stereo, 2-record set, World Record Club S/5069, S/5070.

The first of these two discs invites comparison with a number of single albums of traditional Australian verse, which we have reviewed in these columns. While the initial impression is of a rather heavy performance by Peter O'Shaughnessy, this is soon dispelled by his unsurpassed dialect and his impersonation of such characters as "The Man From Ironbark", the priest in "A Bush Christening" and

the characters in P. J. Hartigan's "Said Hanrahan". Other tracks on this first record include: The Sick Stockrider (Gordon) — Cobb And Co (Lawson) — Ballad Of The Drover (Lawson) — Clancy Of The Overflow (Paterson) — The Man From Snowy River. (Paterson) — Tangmalagaloo (Hartigan) — How McDougall Topped The Score (Spencer) — Hitched (Dennis).

Record 2 is completely different in character and rounds out a set which a member of my family — an English teacher — says would be invaluable for use in secondary schools. For this reason it may be helpful again to quote Authors and titles. Mary Gillmore: Old Botany Bay; The Primeval Australia — Judith Wright: Bora Ring; The Old Prison; South Of My Day's Circle; Brother and Sisters; Country Town; Bullocky — Roland Robinson: Might I Find My Country; The Bush Awakes — A. D. Hope: Australia — R. D. Fitzgerald: The Transaction — David Campbell: Windy Gap; Spring Hares; Harry Pearce; Song Of The Cattle; Men In Green — John Manifold: The Tomb Of Lt. Learmonth AIF — James McCauley: from "The True Discovery Of Australia" — K. Slessor: Ticket In Tatts — R. McCuaig: The Commercial Traveller's Wife — B. Dawe: Abandonment Of Autos — D. Stewart: The Man From Adaminaby.

This is quite a collection, well presented and superbly recorded, with O'Shaughnessy's rich voice emanating from complete silence. (W.N.W.).



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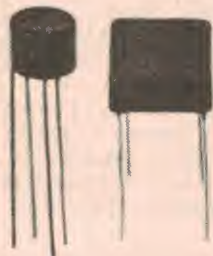
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VARIETY FARE

THE WORLD OF LIBERACE. Excerpts from the TV special. Stereo, Interfusion (Festival) L-35263.

"Perhaps we might have started out as strangers, but I would like to think we wound up as friends..." I guess Liberace would have done so — with the huge live audience, with those watching on television and now with listeners to this album.

I would judge that the album contains only a sampling of the TV show but it hints at the human side of Liberace and a depth of sincerity behind the flamboyant front. It also reveals Liberace as the supreme entertainer, although the musical offerings between the conversational segments are more sparse than some of his other albums: Overture — 14th Hungarian Rhapsody — Boogie Woogie — Medley (semi-vocal) — Hot Pants Routine — Let Me Call You Sweetheart — Strangest Dream (monologue) — Ciao (semi-vocal).

This album forms the strongest possible contrast to the "Showcase" album reviewed recently. This, too, started out as a TV show but it comes across just as strongly as audio only. (W.N.W.)



SAVE THE CHILDREN. Tamala Motown TMOS 3/4 EMI release.

The nineteen tracks on this two record set feature possibly the best selection of black American musical talent that one could wish for, with stars like Nancy Wilson, Cannonball Adderley, Sammy Davis Jr, The Jackson Five, Roberta Flack, Quincy Jones all doing their own thing at Black Expo '72 in Chicago before an audience of twenty-five thousand.

The main theme was 'Save The Children' and the unity of the people gathered together is caught on the record in a truly electrifying way. On one particular track that bears this out, the Rev. James Cleveland leads with a musical sermon based on the 150th psalm, 'Praise the Lord with a Stringed Instrument', stringed instruments in this case including double bass, lead guitar and piano. Considering the barn-like location, the quality is outstanding. (N.J.M.)



DINO DE LAURENTIS. Original sound tracks from 'The Valachi Papers' — 'Crazy Joe' — 'The Stone Killer' Project 3 Stereo L35219. Festival release.

These sound tracks do not in any strong way suggest the Mafia theme that runs through most of the film stories, the only hint being the somewhat Italian strain in some tracks. This comment aside, be prepared to sit back and enjoy some very high quality recording of enjoyable music — in fact the 'demo' disc quality that we have come to expect from Project 3 studios. No orchestra is credited, the only people mentioned being the three composers and the film cast. (N.J.M.)



ERICH KUNZ — German University Songs Vol. 5. Vanguard recording, World Record Club release S/5739.

There are sixteen traditional songs on this record for your pleasure, sung in German by Austrian Erich Kunz, whose warm voice makes for easy listening. A few of the titles are: When I Was A Young Bachelor — The Green Garland — A Tailor Went Strolling — The Jolly Blacksmith's Boys — Now I Mow The Grass Near The Neckar — Now The Time Has Come, etc.

Erich Kunz has an excellent backing in the Chorus and Orchestra of the Vienna State Opera, conducted by Anton Paulik.

The quality is good and a translation sheet packed with the record gives the English words, so if you wish to hum along you know what it's all about. (N.J.M.)

A NIGHT WITH GERSHWIN. Tommy Tycho and the Good Music Orchestra. Harlequin L25166. Festival release.

At the budget price of \$3.99 this record is a 'must' for Gershwin fans; with some of Australia's best musical talents; such as Mary-Jane Boyd, Peter Brandon, Alan Light and the Claire Pool Singers.

Recorded at the Sydney Opera House, the programme includes the following tracks: Somebody Loves Me — Embraceable You — Bess, You Is My Woman — Liza — The Man I Love — Prelude No. 2 — Medley — I'll Build A Stairway To Paradise — Strike Up The Band — Medley — Liza — It Ain't Necessarily So — Piano Concerto in F.

Tommy Tycho's solos alone would make the record worth buying. The sound quality is excellent. (N.J.M.)

★ ★ ★

VIOLIN CONCERTOS by Mendelssohn and Bruch. Nathan Milstein, violin, with the Philharmonic Orchestra, conducted by Leo Barrin. Stereo, World Record Club. S/2407.

I bought this record on its first release here, every bit of 15 years ago, and for a long time after it was the only version I had of these two great romantic violin concertos, so I know the performances well.

Milstein plays, as one would expect, with complete assurance and technical mastery, dominating the orchestra with his big tone. The splendid Philharmonic Orchestra provides fine support.

To intending purchasers I can say that these performances have given me a great deal of pleasure over a long period, but of course the recording does show its age on high quality equipment. (H.A.T.)

★ ★ ★

LET THE GOOD TIMES ROCK. Sandy Nelson United Artists L35239. Festival Release.

Rock'n Roll hits from the late 50's with a strong emphasis on drums would be the best description of this disc. With excellent quality and effective use of the stereo image, the titles run as follows: Bo Diddley — Lucille — Rock Around The Clock — Jailhouse Rock — Conga Fu — Keep a-Knocking — Peggy Sue — Sweet Little Sixteen — Rip It Up — Whole Lotta Shaking — Let There Be Drums. (N.J.M.)

★ ★ ★

ROGER WILLIAMS, The Way We Were. MCA 7623 Stereo. Astor release.

Roger Williams' keyboard talents show through to advantage in this enjoyable recording of ten current favourites. The titles: The Way We Were — Time In A Bottle — Dark Lady — Solace — Delta Dawn — Half Breed — Love's Theme — Behind Closed Doors — The Most Beautiful Girl — Goodbye Yellow Brick Road. With a very competent backing group and occasional chorus, Miller certainly gives a good account of himself. (N.J.M.)

★ ★ ★

CHRISTMAS WITH WALDO DE LOS RIOS. Hispavox L35311 Stereo Festival release.

This record arrived a little late for Christmas 1974, but keep it in mind for next Yuletide. Waldo de los Rios gives ten favourites the full orchestral works, with bells, chimes and a strong percussion section, giving quite a different sound to the usual lush, 'big orchestra' sound we hear so much today.

The titles are: Carol Of The Drum — The First Noel — Silent Night — It Came Upon The Midnight Clear — Tannenbaum — O Come All Ye Faithful — White Christmas — Hark The Herald Angels Sing — Jingle Bells. Rush out and buy it now Christmas is getting closer every day. (N.J.M.)

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Books & Literature

X-ray pioneer

WILLIAM DAVID COOLIDGE, A Centenarian and his work, by H. A. Liebhafsky. Published by John Wiley & Sons, New York, 1974. Clothbound, 157 x 235mm, 96pp, with illustrations. Price in Australia \$8.00.

Although nowadays his name may be almost unknown, W. D. Coolidge was at one stage nearly as well known as Thomas Edison or Henry Ford—and rightly so. In many ways he represented the last of the big US “scientist-entrepreneur” figures. If my memory serves me, he passed away last year only a few months after this book was published.

For those unable to place him, he was the man responsible for discovering how to turn tungsten into a useful metal. It was Coolidge who found how to make it ductile, so that it could be used to replace the fragile carbon filaments used in the Edison incandescent lamp. And it was Coolidge who used tungsten to make the first really practical X-ray tubes (still called Coolidge tubes by many, in his honour).

He also had the distinction of being Director of the General Electric Research Laboratory during the twenties and thirties, which were a most productive period. And to cap it off, he lived to the ripe old age of 100—no mean achievement.

This little biography of Coolidge was written by one of the many scientists who worked under him at GE, to mark the occasion of his centenary celebrations on October 1973.

For anyone interested in modern history of science, it makes good reading. There aren't many pictures, but enough to get a reasonable idea of the man and his life.

The review copy came from the local office of the publisher, but copies should be available at most bookstores. (J.R.)

Pulse primer

ELEMENTS OF TRANSISTOR PULSE CIRCUITS, by T. D. Towers, second edition. Published by Newnes-Butterworths, London, 1974. Hard covers, 140 x 225mm, 198pp, many circuits and diagrams. Price in Australia \$9.00.

The second edition of this book, which is now fairly well known. It has been updated a little from the first edition, but not to the extent of dealing with modern IC equivalents of the discrete circuits discussed. To my mind this means that it will

be quite suitable as a general primer in the pulse field, but of little use when it comes to practical circuits.

Still, those needing a primer to help them in getting started with the general concepts of pulse circuitry should find it well worth the modest cover price. The chapter headings give a good idea of the content:

1—Semiconductor and Pulse Circuits; 2—Linear Pulse Amplifiers; 3—Astable Multivibrators; 4—Monostable Multivibrators; 5—“Eccles-Jordan” Bistable Multivibrators; 6—Waveform Shaping; 7—“Pumps” and “Schmitts”; 8—Blocking Oscillators; 9—Gates; 10—Counter-Timers; 11—Timebases.

The text is generally well written, and well served by illustrations.

In short, then, good as far as it goes.

The review copy came from the local office of the publisher, who advises that stocks should be held by all major bookstores. (J.R.)

ARRL handbook

THE RADIO AMATEUR'S HANDBOOK, 1975 Edition. Published by the American Radio Relay League, Newington, Connecticut. Soft covers, 165 x 242mm, 700-odd pages, many illustrations. Price in Australia around \$7.50.

This is the 52nd annual edition of the well-known ARRL Handbook, which together with the RSGB Radio Communication forms the “twin Bible” of amateur radio. It's much the same as last year's edition, but there has been usual updating and revision—primarily in the projects.

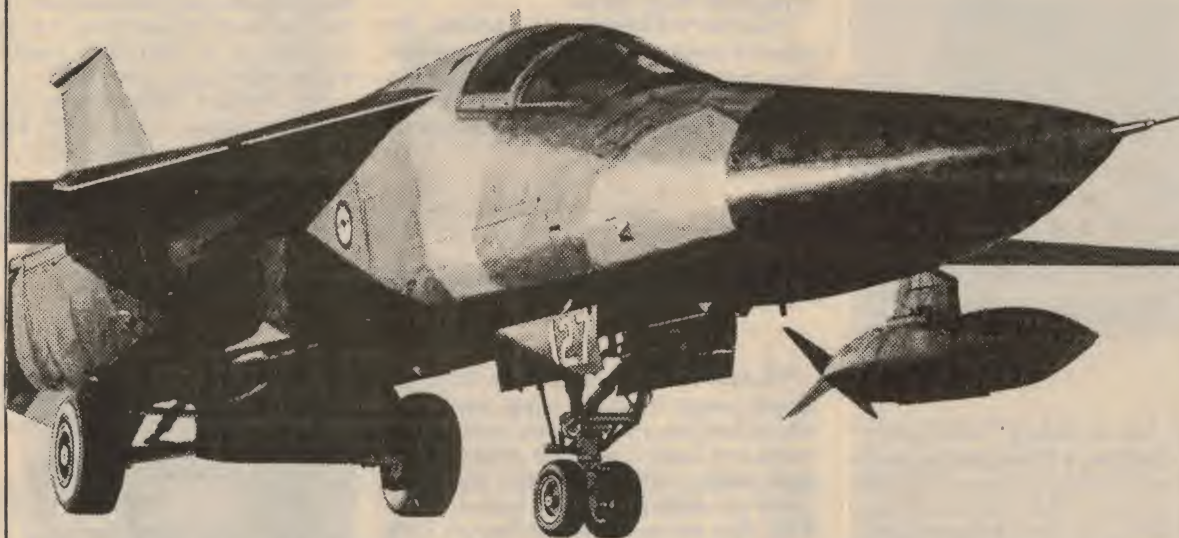
New projects include a 160 metre amplifier, solid state SSB/CW exciter, a direct conversion receiver for 20 and 40 metres, a transverter for 160 metres, a 10/15m preamp and assorted aeriels.

Despite the changes it's still the old familiar handbook, a vast store of information for both the newcomer and the long-established radio amateur.

If you're one of the former, looking for an initial reference, it would make a good choice. On the other hand if you are in the latter group and your old edition is getting a bit dated, this one would make a worthy successor.

The review copy came from Technical Book and Magazine Co, of 289-299 Swanston Street, Melbourne, who will have good stocks by the time you read this. We also understand that Dick Smith Electronics have stocks, too. (J.R.)

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Some of the so-called "conductive" materials which were introduced on to the market about 25 years ago, were relatively normal materials which had to be rendered conductive by the subsequent addition of particle fillers. They were variously successful, depending on the choice of filler and the thoroughness of its distribution during preparation.

Dotite products have known and predictable conductivity characteristics because in the form supplied, they already include very finely divided silver or carbon particles, evenly dispersed. They are the result of co-operation between the Electrical Communication Laboratory of the Nippon Telegraph and Telephone Corporation and the Fujikura Kasei Company.

Typifying the molded form, Dotite conductive sheet plastic is available having physical properties broadly similar to ordinary non-conductive sheets. Dotite literature refers to it as "SV-1" type plastic sheet, typically 150mm square and in thicknesses of 0.5, 1, 2 and 3mm. It lists the main physical properties, resistance and current carrying capacity, the relationship between resistance and temperature and stress, typical applications, &c.

About ten different paints are listed in the literature, most of them containing distributed silver particles. The paints are

It suggests that, in general, the paints can be applied by any of the usual methods, depending on the nature of the work: brush, spray, dipping, dropping, flow coating, stencil, silk screen, etc.

One apparent possibility is the use of paints to create prototypes for PC boards. Components are mounted on mock-up boards and the connections established by painted lines.

The product illustrated is Dotite "S-1" conductive paint, which looks and smells like clear acetone. As supplied for our inspection, it came with a detailed set of instructions with just one drawback: they were entirely in Japanese!

While this has not inhibited use of the product in some local research centres, Ralmar are currently trying to obtain equivalent literature in English.

Like the paints, Dotite adhesives become conductive only after curing. With appropriate use of reagents and curing procedure, the adhesives can be used with a variety of materials including Dotite sheet and metals. The adhesive is recommended in situations where it is necessary to establish a conductive junction, but where soldering is not practical.

For further information on Dotite products: Ralmar Agencies Pty Ltd, 71-73 Chandos St, St Leonards, NSW 2065.

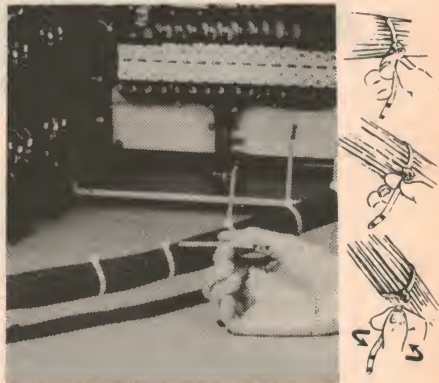
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Any organisation or person with the need to make multiple copies of cassette tapes will be interested in the Telex Cassette Copier I and II. It has a claimed frequency response of 40Hz to 10kHz at a copy speed of 76cm/second.

Many organisations such as libraries, technical colleges and clubs, sales department of companies and organisers seminars often require a rapid cassette copier to make multiple duplicates. The Telex Cassette Copier is just such a machine, for making duplicates of mono cassettes.

Since it is intended for a strictly utilitarian purpose, the Telex Cassette Copier has a very spartan appearance with a blue crinkle finish on the case and an off-white moulded top deck. No lid is supplied for the machine, but a dust cover made of blue-tinted heavy plastic sheeting keeps the machine clean when not in use.

Dimensions of the Copier are 400 x 455 x 190mm (W x H x D) and weight is 14.5kg.

All the heads, replay only on the original deck and erase and record on the duplicate deck, are two channel half-track units instead of the quarter-track heads used on stereo cassette recorders. Either or both tracks of the heads is selected by the Track Selector switch to duplicate either or both sides of the master cassette.

This latter feature means that material from more than one master cassette could be copied onto the two sides of the duplicate cassettes.

When both sides of the master cassette are being copied simultaneously, the "B" side (lowermost on the deck) is actually traversed in the reverse direction, as far as the head is concerned. However, this has no effect on the final result.



Telex Cassette Copier 1 and the slave Copier 2 are almost identical in appearance apart from the controls.

Two versions of the Cassette Copier are available, a master and a slave unit, designated Copier I and Copier II. Our photograph shows the Copier I. Both master and slave units are the same in appearance, apart from the controls. Whereas the slave unit merely has a Stop button, the master has two buttons for Rewind and Copy and a track selector.

Two transport mechanisms, powered by a large common motor and referred to as decks in the Telex manual, are provided. On the left is the deck for the master cassette, while the right deck is for the duplicate cassette. The slave Copier II also has two decks, but both of these are for duplicate cassettes.

Master Copier I has output sockets on the underside of the chassis to which two slave copiers may be connected. With two slave units in use, five duplicate cassettes can be made simultaneously.

Solenoids are used to control all functions of the transport mechanisms. At the end of a cassette, the drive to the particular mechanism stops while the other cassette keeps on winding. This is necessary because of the slight differences in tape length, between C60 cassettes, for example. When both cassettes have come to the end of their tape, both drive mechanisms are disengaged and the machine pauses for a moment.

Then both cassettes are rewound at a rapid rate. Rewind speed is quoted at 178cm/sec (70 inches per second) and is such that it takes about 45 seconds to rewind a C60 cassette. That is almost twice as fast as the rewind facility on domestic cassette players.

Copy speed is 76cm/sec (30 inches per second). The time taken to copy a C60 cassette is just under two minutes, while taking the automatic rewind into account

brings the total time to 2 minutes 45 seconds.

Frequency response is rated rather vaguely at 40Hz to 10kHz, while signal-to-noise ratio is quoted at 45dB and harmonic distortion at less than one percent at -7dB. Wow and flutter is 0.25% or less. Bias oscillator frequency is 600kHz. We had no calibration cassettes available at the time of writing this review, so we cannot comment on the specifications. However, we can state that copies made of good quality cassettes showed no appreciable degradation.

Heads, capstans, tape guides and pinch rollers are all easily accessible for cleaning without removing the top cover. The manual recommends that cleaning of the above be performed every day when the machine is in more or less constant use.

All circuitry is solid state and is mounted on well shielded printed boards with plug-in connections throughout. Accessibility to the interior of the machine is good and there is an overall impression that the Telex Copier is a machine built for work rather than just to look impressive.

In short, for organisations that need the facility for making rapid, good quality cassette copies, the Telex Copier I and II appear ideal. Price of the Copier I is \$960 plus sales tax where applicable.

Further information can be obtained from the Australian distributors for Telex, Philips Vision and Sound, 200 Goulburn Street, Sydney, 2000 or interstate offices. (L.D.S.)

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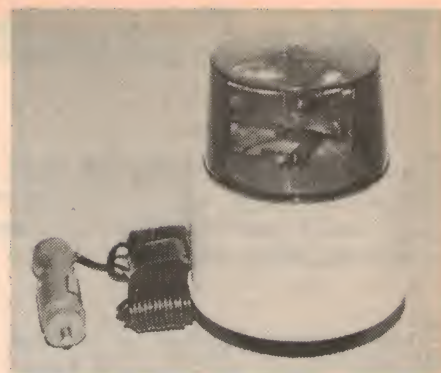
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a flashing red light, visible from all directions. A robust and well made unit, it would be a valuable addition to the equipment of any road vehicle or boat. Normal price of the emergency flasher is \$7.75 plus 80c for packing and postage. (ACE Radio, 136 Victoria Rd, Marrickville, NSW 2204).

Hybrid thermal switch

Hybrid Electronics Australia recently announced the development of a thermal switch which undergoes an extremely dramatic change of resistance with temperature at 70°C. This unique property gives the thermal switch applications in areas such as electronic circuit protection, motor protection, air conditioning, fire protection, and high stability thermal ovens—in short any application having a

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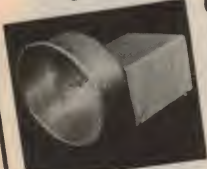
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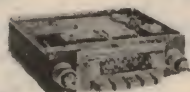
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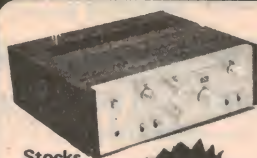
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A very compact 12" speaker system able to handle 60 watts music power. This system features a "super-tweeter" (horn), a 3 1/2" tweeter, a 6 1/2" mid-range and the 12" bass driver, a total of 4 speakers with a 4 way L-C Crossover network. The sound result is almost as realistic as a "live" performance, as tests have shown a frequency response of 15 Hz to 30 kHz. The cabinet, of walnut colour, measures 64 x 38 x 29 cms.



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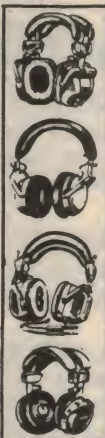
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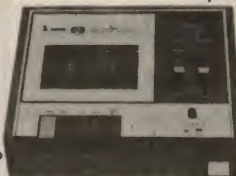


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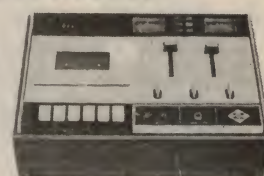
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This stereo cassette tape deck has all the features you would need for home entertainment purposes, e.g. counter, twin VU meters, aux. inputs, slider-type level controls, attractively styled walnut coloured cabinet etc. Using high quality extra dynamic tapes, you will achieve excellent sound recordings with wide frequency response. Recommended retail price is listed at \$119.00 save \$10.00; offer ends 30th April.

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for cassette & records

The basis of this home entertainment centre is the stereo cassette tape recorder CST-105. Main specs., are @ freq. response 50 Hz — 10 kHz, wow and flutter 0.25% sig to noise 40 dB, distortion 2%. A Garrard 6-100 stereo record changer is included — all prices are perfectly matched in walnut colour and mics and leads are included.



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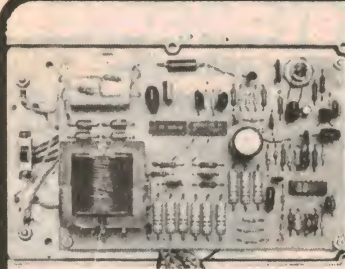
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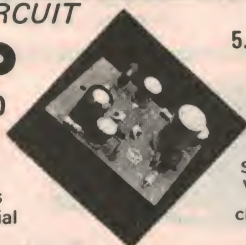
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5.5W in 4Ω at 14.4V
2.3W in 4Ω at 9V
1W in 4Ω at 6V
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Stereo kit complete with mag input and bass/treble, incl. chassis, transformer, slider controls etc.
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Ultra low battery drain (1mA)
Entry — exit time delay system

This simple but highly effective alarm control module is suitable for home, office or factory and may also be used as a fire, smoke or gas alarm or other emergency system. A 30 second time delay is allowed for exit or re-entry after which the alarm is "armed". Operates from 12V, relay output to switch on bell etc.

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Dual 4W output, fully gtd without speakers
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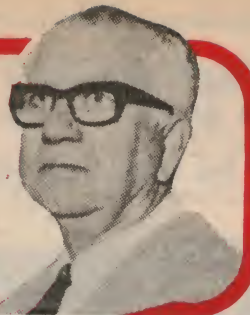
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The Amateur Bands

by Pierce Healy, VK2APQ



The Darwin disaster

Amateur radio provided a very valuable service when radio, telephone and telegraph systems between Darwin and other capital cities were given the severest possible test following the effects of the cyclone which struck during the early hours of Christmas morning, 1974.

Except for those who were directly affected by the cyclone, the tragic event is fading in the memory of most people. Yet, one aspect of the disaster which touched everybody in Australia was the impact that radio and television made throughout the nation in sponsoring large fund raising appeals to assist those who lost homes and personal possessions.

Radio also played a major role in providing communication during relief operations. In addition to the normal channels provided by the OTC, amateur radio through the Wireless Institute Civil Emergency Network (WICEN) gave valuable service. Contrary to reports which appeared in some of the major daily newspapers, Darwin was not at any time completely devoid of official communication channels with other parts of the continent, in particular, Sydney and Canberra.

The value of amateur radio, as a service available to the community in times of emergency, was shown beyond doubt and on a scale never before called upon.

However, it is unfortunate that many daily press reports referred to the work by amateur radio, not out of regard for it as a service, but to boost veiled criticism of the PMG, OTC and military communication services.

Much harm can be done to amateur radio status in government administrative circles if exaggerated claims—such as being the only means of communication out of Darwin immediately following the cyclone—are perpetuated by amateurs themselves.

What is true is that the amateur network linked all areas of the continent. In addition to Darwin, the network contained stations in Gove, Mount Isa, Cairns, Townsville, Mackay, Rockhampton, Brisbane, Lismore, Sydney, Canberra, Cooma, Melbourne, Birchip, Adelaide, Alice Springs and Perth. There were many more stations maintaining a listening watch on the channel, participating only if required to assist as a fill-in relay point. Many stations were on standby around the twenty-four hours of each day and the total number of operators probably runs into several hundred. The total number of messages handled was no doubt very large.

Details of all amateur participation probably never will be fully recorded. However, one authentic report on the initial action and activities, during the three days following the cyclone,

has been provided by Garry Gibson, VK2BNN and his wife Wendy, VK2BYL, whom I had the pleasure to meet and hear first hand their experiences and impressions of what took place.

Early in December, 1974, Garry, Wendy, and nine month old daughter Korin, moved from Sydney to Darwin, where Garry was to take a position as TV technician at the Darwin Community College, Casuarina, about 14 kilometres

The emergency radio station in the Darwin Community College. Garry Gibson, VK2BNN, is standing and the relieving operator, "Slim" Jones, VK8JT, is seated in front of Garry's equipment. (Photo by Mr G. Wahlquist, Darwin Community College.)



from the city. Until three days before Christmas, when they moved into their own house, they had stayed at a motel. The cyclone flattened the motel, but only the roof was torn from the house. Sheltering for the night in a cupboard they escaped injury. The SSB transceiver which he had placed in the protection of the cupboard also escaped damage. But not so the power supply which had been overlooked and was saturated with water.

The story as related by Garry and Wendy, tells of setting up a station, the equipment used, and the untiring assistance given by many who, like themselves, took shelter in the college buildings.

However, to quote Garry, "The original intention of setting up the station was not to call for assistance, but to acquaint amateurs in the eastern states of the devastation caused by the cyclone and how we, and others, had fared".

About 7.00am on Christmas morning Garry

and his family moved from their house to the very much less damaged college building. Thanks to his initiative, assisted by Wendy and members of the college staff, by about 10.00am his Hallicrafters SR150 transceiver was on the air. This was the station which was to play a major role in handling emergency traffic out of Darwin.

At this stage the transceiver was fed into a CODAN aerial coupling unit and a 10 metre length of wire tied at arms height to a pole near one of the college rooms. This room became the emergency communication centre for the Darwin amateur net.

The initial call was made on approximately 14.110MHz, under the call sign VK2BNN/P8, but no replies were received. While Garry and others were considering what could be done to improve performance, Trevor (Slim) Jones, who had come to lend a hand, gave a call on Garry's equipment, using his own call sign, VK8JT, and was answered by Ken McLaughlin, VK3AH, in Melbourne. Several other contacts were made and when it became obvious that emergency traffic was to be handled, the call sign VK8JT was retained to avoid possible confusion.

Shortly after a very large network formed on the frequency ready, if required, to handle emergency traffic to administrative authorities and other organisations assisting in relief and evacuation work. The net control station was in Melbourne.

Two who played a major part in maintaining the Darwin station, and VHF links established later, were Nigel Muddle and Joe Maidens. Nigel was the electronics teacher at the college, had been a commercial operator, and was capable of operating on CW should the necessity. He assisted greatly in maintenance and traffic clearing. Joe was the maintenance mechanic who brought the college 2.5kVA petrol-electric generator into operation. The small fuel tank required re-filling every 1.5 hours and Joe did not have more than 90 minutes' rest at any one period for three days.

In addition there were about 20 persons assisting by doing the foot-work around the station, particularly between the college and the Casuarina Police Station before a VHF link was established. This link originally consisted of a hand-held walkie-talkie operating on the police frequency, until the batteries ran down and the charger could not be located.

The link was re-established several hours later with commercial 67MHz units, flown in from Mount Isa.

Attempts were made to set up a link between the college and Darwin Police Headquarters, but permission to do so was refused. All traffic

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

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AMATEUR BANDS

was via the link with the Casuarina police and then relayed to Darwin.

From early Christmas evening a senior police officer was at the station to authenticate messages. These officers gave much needed assistance in obtaining such things as petrol to keep the generator operating and a hand held hair drier to dry out equipment. This included the transceiver power supply, from which the filter capacitors had been removed and strung out-board to allow the moisture absorbent casings to dry out.

Another link, established and manned by army personnel, operated between the college and the evacuation centre Darwin. This link was completely independent and did not tie in with the amateur and police link. The equipment was a type 25 set.

Except for short periods while refuelling the generator and the re-assembling of the power supply, Garry's Hallicrafter SR150 was in continuous operation for three days. On the evening of the 27th they received an FT101B, flown in by Owen Marshall, VK8OM, in his private aircraft. Doug McArthur, VK8KK, also arrived about the same time.

During that period the aerial system at the college had been upgraded to an inverted "V" dipole, with the apex about 5 metres above ground. Also a 7MHz dipole was made up by Wendy for use if it became necessary to operate on that band.

Until the evening of Christmas Day, when a duplicate-copy book was found, log sheets were used as message forms to the Casuarina Police Station. It appears certain that the records of the traffic handled during that period have been lost. Nor is it possible to recall many events. Due to the almost continuous operation, even keeping track of the days became a problem.

After the station had been closed as an official emergency unit, inquiries were being received about stretcher cases, who had been evacuated, from relatives still in Darwin who were concerned about their wellbeing. Permission to handle this type of third party message was initially refused. But a telegram to the Postmaster-General repeated as information to the Prime Minister, reversed the situation. A reply authorising such traffic was received within twenty minutes.

Conditions on 14MHz in Darwin during the period was good most of the time, especially from Queensland stations, and at times Melbourne. Maximum signal strength nearly all the time was received from VK8CW in Alice Springs.

During the first day of operation the 14MHz net frequency was kept clear. By the end of the second day interest by the onlookers appeared to wane and interference on the channel increased considerably.

During the first three days the amateurs operating the station were Garry VK2BNN, Trevor (Slim) VK8JT, and Wendy, VK2BYL. Wendy took turns operating during the quieter periods of the night. Maintenance, which was not without its problems, was by Garry Gibson and Nigel Muddle. The generator serviced by Joe Maidens, not only supplied power for the transceiver and VHF units, but also for make-shift coolrooms for food storage. At one period more than 100 adults and a number of small children were sheltering at the college waiting to be evacuated.

Nigel Muddle had, just prior to Christmas, applied for an amateur licence but had not

received a reply. He and Garry had planned to start an amateur radio course at the college.

Apart from the operations at the college at Casuarina, the first amateur to make contact from Darwin on Christmas morning was Bob Hooper, VK8RR operating mobile from Fanny Bay. This contact was with Harry Simpson, VK6HS at 0915 Darwin time. Details of the damage caused by the cyclone was passed by VK6HS to Perth Radio.

Bob Hooper is manager of OTC station VID Darwin and was apparently endeavouring to make his way to the station at Parap.

To further clarify the communication story, here are some details from Walter (Blue) Easterling, VK2ABL, of the staff of OTC Sydney.

The OTC Darwin Coast Radio Station was relocated at Parap in 1948-1949, 7 kilometres from the city. There has always been a bad QRN (static) problem in Darwin and OTC had sited remote receivers at the DCA station at Lee Point, with a 160MHz link to Parap, and one at the PMG station on Cox Peninsula, linked through a microwave bearer to the Mitchell Street exchange in Darwin then by landline to Parap. There were also backup receivers at Parap.

Like other masts in the Darwin area the masts at Parap did not survive the 200kmH winds. However the station building took very little damage, possibly due to being built close to the ground. Some water was forced through the windows and doors; but generally speaking the equipment was undamaged. The emergency diesel generator was also intact. All the staff houses were badly damaged and the staff with their families took shelter in the station building.

The Lee Point and Cox Peninsula stations were wiped out.

During the early hours of Christmas morning VID Darwin telexed Marine Operations Canberra advising that the remote receivers were out of service. MOC then advised VIS Sydney. VIS telexed VID twice to discuss the situation. During the second telex the line went out.

Shortly after this the Western Australian State Shipping Service vessel NYANDA/VMNA contacted VIS Sydney on 12MHz as it was entering Darwin Harbour. When it had berthed at the Stokes Hill wharf, two operators from OTC went aboard and about 1040 hours commenced operations from the ship under the call sign VID2.

At the Sydney end, OTC put into operation a 30kW transmitter and a rhombic antenna. The operators at both ends were experienced in commercial work and large blocks of official traffic were handled. This was telexed from VIS straight into Marine Operations Centre Canberra where it was cleared to the various authorities.

The circuit was maintained for five days continuously, except when the ship shifted to a paired radiophone frequency for calls to the PMG terminals at Sydney and Perth.

OTC flew a trouble shooting party into Darwin on Boxing Day; the Director of Administration, Tom Molloy, the Assistant Manager—Coastal Radio Services, Arch Barrie (VK2BH); and three skilled riggers. In the meantime staff at Darwin were working hard to restore services, patch up two of the least damaged houses, care for their families, try to salvage personal effects and stand watches at VID2.

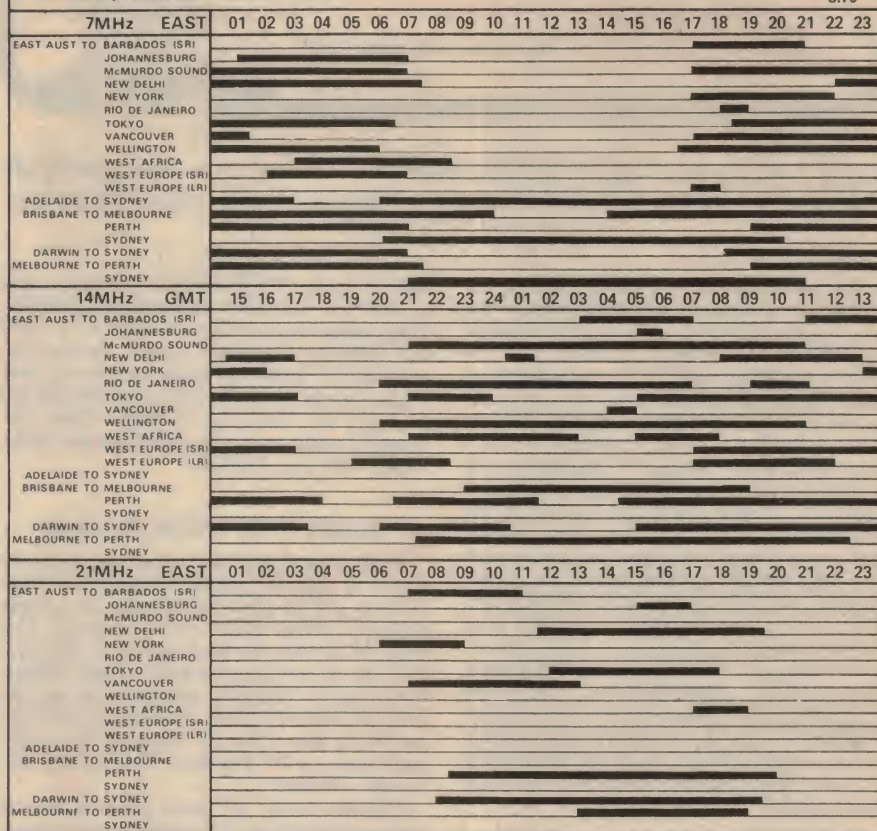
By the evening of Boxing Day they had a small ship frequency (4136.3kHz) working from Parap, plus 500kHz and 2182kHz from the ship. Early the next day restoration of other circuits followed, even an RTTY link into Sydney.

By Friday afternoon 27th December, 1974 the Darwin GPO was back in business on TRESS (Tape Reperforating & Switching System). Telephone and telex were restored to VID Parap

IONOSPHERIC PREDICTIONS FOR MARCH

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open.

3.75



on Saturday 28th. STD had been restored to some subscribers the previous day—a lady in Sydney telephoned a friend at Darwin Hospital on the Friday afternoon.

In Darwin virtually every overhead line, electricity and telecommunications, had been torn down and subscribers' equipment destroyed or damaged.

Many of the commercial operators working the VIS/VID circuit have held or hold amateur licences. Among these are VK8RR, VK2WL, VK2AOW, VK2BCV, VK2AFD (ex-G3PLQ), VK2ABL, ex-VK2AQO and ex-VK9RI. There are many more at the transmitting and receiving stations at Doonside, Bringelly and Perth. At all levels there was a fusion of commercial and amateur licensees working for the common good.

Summarising the situation as it existed: Telex in operation until 0647 hours 25 December; possibly later in the town area.

VMNA QSO with VIS at about 0645 hours; VID2 operated from VMNA from 1040 hours onward.

There was commercial contact with Darwin, one way or another, almost without a break, and ready for traffic when it was eventually offered.

The fact that commercial communication circuits were in operation, does not in any way lessen the praise and appreciation for the service amateurs provided during the emergency. In particular, that due to the operators and assistants at VK2BNN-P8/VK8JT Darwin, where operating and living conditions were primitive compared with those enjoyed by others who participated.

In fact, one of the most significant aspects of the whole operation was that, within a few hours of the disaster, amateurs were able to

establish and maintain a well organised, well disciplined net, covering all major population areas of the Australian continent. The extent to which it was used is less important than the fact that it was there—ready to be used!

NOBEL PRIZE TO AMATEUR

The 1974 Nobel Prize for Physics has been awarded to Professor Sir Martin Ryle, FRS, G3CY. The prize was shared jointly with Professor Antony Hewish which was awarded for their pioneering work in radio astronomy. Both men have worked together at the Cavendish Laboratory, Cambridge for 25 years.

Professor Ryle has been Professor of Radio Astronomy at Cambridge since 1959, is director of the Mullard Radio Observatory, and is an Honorary Member of the Radio Society of Great Britain.

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Shortwave Scene

by Arthur Cushen, MBE



Radio Sahara has been widely reported on its new frequency of 11805kHz, making another country available to shortwave listeners.

The transmission of Radio Sahara on 11805kHz commences at 0758GMT with the interval signal and announcements in Spanish at 0800GMT. Following a short musical interlude, broadcasts in Arabic commence at 0805GMT. Signals in Australia have been observed by Geoff Cosier, Robert Hanner and Bob Padula of Melbourne, who report good reception, while John Mainland of Wellington and the author are also enjoying similar conditions.

Our first reception of Radio Sahara was on the medium-wave frequency of 656kHz (using 50kW) and is heard in New Zealand around dawn. According to the verification, the station operated on 7230kHz with 10kW and 4626kHz with 5kW. This new signal on 11805kHz is of excellent quality and suggests a higher power.

The schedule of the station in Spanish is 0559-0800GMT, 1100-1900GMT, and 0100-0115GMT; and in Hassania and Arabic 0800-1100GMT and 1900-2100GMT. The station verifies reception with a letter and the address is: Radio Nacional de Espana, PO Box 106, Asiu, Sahara.

SRI LANKA EUROPEAN SERVICE

The Sri Lanka Broadcasting Corporation at Colombo is heard with a daily service to Europe in English from 1900-2000GMT. Reception has been excellent on 11800kHz, while two other frequencies, 15120 and 9720kHz, also carry the program. The transmission includes request music at 1900GMT and a news bulletin at 1915GMT.

According to announcements the station is keen to receive reception reports, and these should be sent to the European Service, English Department, Sri Lanka Broadcasting Corporation, PO Box 1510, Colombo, Sri Lanka.

ISRAEL'S NEW CHANNELS

The Israel Broadcasting Authority has announced that technical problems experienced with its new 300kW shortwave transmitters and aerial systems have been rectified and, consequently, some changes in frequencies and beaming will be made. Our own observations, supported by those of the BBC Monitoring Service, show that the English transmission at 0500GMT is beamed to Western Europe and North America on 9815, 9009, 7395 and 5900kHz.

Other frequencies for these broadcasts are 12025, 9625, 7125 and 6000kHz. The English

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are in GMT. Add 8 hours for WAST, 10 hours for EAST, and 12 hours for NZT.

Service from 1130-1200GMT is now beamed to Australia and New Zealand on 15240kHz. This transmission is also on 21590, 17690, 15100 and 9009kHz. The third English transmission at 2000GMT is beamed to Western Europe and North America on 9630, 7395 and 5900kHz and to Africa on 17690 and 9009kHz. Other frequencies which carry this broadcast are 12025, 11643, 9815 and 9525kHz.

RADIO SPECTRUM COURSE

Radio Nederland this month is starting a new course in the DX Jukebox program in which listeners will be given information on various subjects covered in the radio spectrum. This series of 12 talks has been written by Jim Vastenhoud, of the technical staff of Radio Nederland, who has compiled many interesting talks over the past few years. The text of the talks are being issued free to listeners who make application to DX Jukebox, PO Box 222, Hilversum, Holland.

The new course will cover the intricacies of the radio spectrum, the types of radio transmission, allocation of bands, satellite usage, the radio zones and seasons, and will take a look at the expected development of radio in the next decade. The DX Jukebox program is broadcast every Thursday at 0645GMT on 11730kHz and at 0815GMT on 9715kHz, as well as in all English transmissions broadcast on Thursday.

FEBA ON 11740kHz

Station FEBA in the Seychelles has been heard on the new frequency of 11740kHz to sign-off at 1800GMT. The transmission consisted of Gospel music and programs in African languages, with the interval signal played each thirty minutes. The interval signal, which is part of the hymn "What a Friend We Have In Jesus," is played at 1800GMT followed by a short English announcement advising listeners that the station is changing frequency and listeners should retune to 11855kHz. During the closing announcement there is some interference from the Vatican Radio, which opens on 11740kHz at 1800GMT. The address of FEBA is PO Box 234, Mahe, Seychelles.

RECENT VERIFICATIONS

COLOMBIA: A verification letter from Radio La Voz Del Cinaruco has been received by Harry Weatherley of Melbourne. The call sign is HJLZ, and the station operates on 4865kHz with 1kW. Verification was in the form of a letter from Garred Munoz Tello. According to the letter, the station is located on the boarder of Colombia and Venezuela and has an equal audience in both countries. The address is: Calle 22, No 20-38, Arauca, Colombia.

AFRICAN RECEPTION

SWAZILAND: Swazi Music Radio has been heard on 4980kHz by Craig Tyson of Perth and Bryan Clark of Wellington, NZ, up to 1900GMT. The signal is spoilt by some morse interference, but the program in English could be heard with commercials and jingles as well as popular music.

ZAMBIA: Radio Lusaka has been heard on the new frequency of 4950kHz with an English announcement indicating that the broadcast is in the External Service. News was heard at 1704GMT by both Bryan Clark and Craig Tyson.

ANGOLA: Dene Lynneburg has reported in the New Zealand DX Times that Luanda has been heard on 7245kHz with a Portuguese sports commentary at 2225GMT. There is some interference on this channel from Radio Free Europe.

MEDIUM-WAVE NEWS

BAHRAIN: The Bahrain Broadcasting Station is now on 615kHz, having moved from 610kHz. "Sunpot" reports that a new station, Radio Television Bahrain, is to commence operations on 570kHz from 0300-2100GMT, with broadcasts in Arabic, English, Farsi, Hindu and Urdu.

AUSTRALIA: The latest repeater station of the ABC to come into operation is 8GO, Gove, Northern Territory. The new station transmits on 990kHz with a power of 500W, and uses an omnidirectional aerial. The station carries programs from 8DR Darwin, which are also relayed by 8AL Alice Springs, 8TC Tennant Creek, and 8KN Katherine.

LISTENING BRIEFS EUROPE

GERMANY: According to the BBC Monitoring Service, the experimental broadcasts of Deutsche Welle have been heard from 2030-2050GMT on 11905, 11795 and 9756kHz. These replace the scheduled transmissions in French to West Africa.

FRANCE: Listeners are advised that "ORTF Paris" is no longer the slogan for the French radio on shortwave. English broadcasts from the station are now transmitted using the slogan "Radio France".

ASIA

SRI LANKA: According to Robert Chester of Adelaide, the Voice of America relay station at Colombo was noted with fair signals at 1600GMT on 9625kHz with the news in English. This frequency is scheduled from 1530-1600GMT in Hindu and from 1600-1815GMT in English.

PAKISTAN: Radio Pakistan has recently changed schedule for its English news bulletin, according to the BBC Monitoring service. The bulletin has been heard on 4975, 4060, 3885 and 3400kHz on the new time of 1700GMT which replaces the old time of 1600GMT.

AMERICAS

FRENCH GUIANA: Cayenne is reported by "Tropical DX-ers" as opening on 3385kHz at 0920GMT with the La Marseillaise and opening announcements in French. At 0930GMT, following a time signal, the station relays a program from Paris.

MARTINIQUE: Port de France has been heard in North America on 5995kHz. Reception was at 1140GMT when programs were in French, and was marred by interference from Radio Australia.

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Frequency response	70 - 20,000 Hz
Sensitivity	93 dB
Capacity	35 W

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50W, 3-way, 3-speaker system in kit form includes all speakers, crossovers, terminals, wire, screws, coral emblem for front of box.

The features as assembled in a designated cabinet are as follows:

Features (10SA-1)	
Type of cabinet	Closed type
Type of speaker	3-way 3-speaker
Input impedance	8 Ohms
Crossover frequency	2,000 - 8,000 Hz
Frequency response	40 - 20,000 Hz
Sensitivity	93 dB
Capacity	50 W

PRICE \$50.00 PAIR



12" SPEAKER SYSTEM KIT 12SA-1

60W, 3-way, 4-speaker system in kit form includes all speakers, crossovers, terminals, wire, screws, coral emblem for front of box.

The features as assembled in a designated cabinet are as follows:

Features (12SA-1)	
Type of cabinet	Closed type
Type of speaker	3-way 4-speaker
Input impedance	8 Ohms
Crossover frequency	1,000 - 10,000 Hz
Frequency response	30 - 20,000 Hz
Sensitivity	95 dB
Capacity	60 W

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DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: -10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA.
"Eveready" 915.



MODEL RH-60 \$29.00

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AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: -10 + 62dB.
Accuracy: DC ± 3 pc., AC ± 4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.



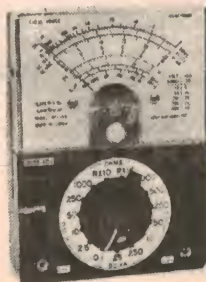
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Pocket size 3 1/4" x 4 1/2" x 1 1/4". Instruction sheet and circuit.

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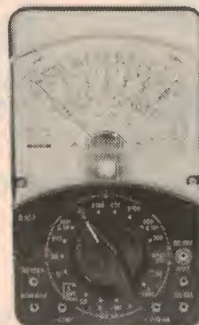
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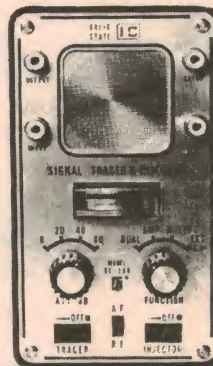
Specifications

DC Volts: 0.3, 3, 12, 60, 300, 600, (30,000 /V), 3000 (3,333 /V).
AC Volts: 6, 30, 120, 300, 600, 1200 (10,000 /V)
DC Current: 0.3mA, 6mA, 60mA, 600mA, 12A, 30A
Resistance: 6k, 600k, 6M, 60M
Accuracy: DC $\pm 3\%$, AC \pm (of full scale)
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SPECIFICATIONS

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Output Impedance: Ext. Speaker 8 ohms.
Output: 600 ohms unbalanced.
Meter: VU 200uA.
Speaker: 2-1/4" dynamic.
Power Supply: Dry Cell BL006P 9V x 1.
Size: 150 (5-13/16) x 85 (3-11/32) x 52mm (2-1/64").
Weight: Approx. 500gs (1.10 Lbs.).
(SE-360 Injector portion)
Frequency: Approx. 1KHz square wave form.
Output Level: Max. 5V (0-5V continuously variable).
Note: Each unit supplied with test leads (Test prod x 1 and test clip x 1).



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INFORMATION CENTRE

FRAME BUZZ: I have problems which must be shared by many of your readers in the major cities. I live a couple of miles from the Mt Dandenong television transmitters which serve Melbourne. During transmission time my stereo system is invaded by a strong buzz-hum which makes listening, especially via headphones, rather trying. Is there anything I can do about this? (M. E. Kalorama, Vic.)

☉ Maybe; maybe not, M. E. First of all, you must try to work out where the frame buzz is getting in. If it is via the mains, a line filter may help. If it is being induced through the speaker leads (and this is quite probable in the "shock area" of a high power transmitter) a filter at this end should be used. You may need both. A line filter was described in the June 1971 issue (File No 2/LF/4), while a toroid filter for speaker lines was described in the June 1974 issue (File No 2/LF/7).

PLAYMASTER 136: Help! I'm at my wits end trying to find out why only one channel of my Playmaster 136 amplifier is working for all sources. I've checked for defective elements and wiring but with no luck. The funny thing is that all the biasing agrees with the mentioned value, with an error of plus or minus 2V in all cases.

The trouble is that I can't use the right channel. Whenever I try to balance the two channels, I get distortion from the right channel. The sound coming through this channel is sort of very high pitched. The bass or treble controls have no effect over it.

Incidentally, why do you choose the first Monday of every month to place EA on sale? Isn't that a bit too much trying to keep readers in suspense? (C. S., Leederville, WA.)

☉ First of all, we point out that it is possible to reverse the collector and emitter of silicon transistors in a circuit and still come up with the correct DC voltage measurements although the circuit will have very little gain. So make very sure that all transistors are connected correctly. Having done this, it is reasonably easy to localise the fault by swapping the outputs

of the two volume control sections. This will tell you whether the fault lies in the tone control or power amplifier. The most likely cause of the fault is an open-circuit coupling capacitor.

On the question of publication date, this is largely determined by the printer and publisher, not the editor. And it seems better to publish on the first Monday of the month rather than six weeks early, as some motoring magazines do. After all, news is news, if you haven't read it yet.

REPLACEMENT TRANSISTORS: Since the silicon output transistors AY 8171/AY 9171 are so much more robust than the germanium AD 161/AD 162, I wonder whether they could be used as replacement transistors for the 10 plus 10 amplifier (April 1969), without extensive circuit changes. I expect that there is still a large number of 10 plus 10 amplifiers in use, occasionally blowing the output transistors. While the use of silicon output transistors would not modernise the amplifier, it would make it more robust. (P. L., Merigandau, Qld.)

☉ While we agree that the silicon transistors are more robust than the germanium output transistors in the 10 plus 10 amplifier, the much wider frequency response of the silicon transistors is very likely to make the amplifier unstable without changes being made. In addition, the biasing and quiescent current stabilising network would probably have to be changed if silicon transistors were used.

RADIO CONTROL: I like reading your magazine and wish to congratulate you on the micro-computer. How about combining your knowledge of digitals with your background of radio and come up with a radio control unit for model planes and boats. I am certain this project would be welcomed by many readers. (G. W. Bondi, NSW.)

☉ We agree, G. W.—such a project would be popular. We cannot promise anything, but we will keep the idea "in the melting pot" should the opportunity arise.

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OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

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- 39 12 VDC 240 VAC 20W.
- 40 12 VDC 240 VAC 50W.
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- 42 24 VDC 800 VDC 160W.
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- 52 —

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- 56 Light Beam Relay.
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- 59 Meterless Voltmeter.
- 60 Wide Range Voltmeter.
- 61 F.E.T. D.C.
- 62 1966 V.T.V.M.
- 63 1968 Solid State V.O.M.
- 64 1973 Digital V.O.M. (1).
- 65 1973 Digital V.O.M. (2).
- 66 High Linearity A.C. Millivoltmeter.
- 67 —
- 68 —

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- 75 —
- 76 —

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- 83 Simple 5V 1A Unit.
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- 85 S.C. Proof 0.30 VDC at 1A.
- 86 Reg 0.30VDC at 3A O/L Protected.
- 87 Variable Reg 12V-0.5A 200KHz.
- 88 Reg O/Load & S.C. Protection 60VDC at 2A (1973) — EA.
- 89 —
- 90 —

R.F. INSTRUMENTS

- 91 Solid State Test Osc.
- 92 Signal Injector & R/C Bridge.
- 93 Solid State Dip Osc.
- 94 "Q" Meter.
- 95 Laser Unit.
- 96 Digital Freq Meter 200KHz.
- 97 Digital Freq Meter 70MHz.
- 98 IF Alignment Osc.
- 99 27MHz Field Strength Meter.
- 100 100KHz Crystal Cal.
- 101 1MHz Crystal Cal.
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- 103 V.H.F. Dip Osc.
- 104 V.H.F. Powermatch.

- 105 V.H.F. F/S Detector.
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- 109 1972 FET Dipper.
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- 112 Frequency Counter & DVM Adaptor.
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- 114 Digital Logic Trainer.
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- 116 Digital Pulser Probe
- 117 Antenna Noise Bridge.
- 118 Solid State Signal Tracer.
- 119 1973 Signal Injector.
- 120 Silicon Diode Sweep Gen.

TRAIN CONTROL UNITS

- 124 Model Control 1967.
- 125 Model Control with Simulated Inertia.
- 126 Hi-Power Unit 1968.
- 127 Power Supply Unit.
- 128 SCR-PUT Unit 1971.
- 129 SCR-PUT Unit with Simulated Inertia 1971.
- 130 Electronic Steam Whistle.
- 131 Electronic Chuffer.

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- 134 Silicon Diode Sweep Gen.
- 135 Silicon Diode Noise Gen.
- 136 Transistor Pattern Gen.
- 137 TV Synch & Pattern Gen.

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- 143 Bright Dim Unit 1971.
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- 145 Fluorescent light Dimmer.
- 146 Autodim-Triac 6 Amp.
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- 148 Stage, etc. Autodimmer 2KW.
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- 153 3 Band 2 Valve.
- 154 3 Band 3 Valve.
- 155 1967 All Wave 2.
- 156 1967 All Wave 3.
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- 158 1967 All Wave 5.
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- 160 1967 All Wave 7.
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- 180 —
- 181 —

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- 182 52MHz AM.
- 183 52MHz Handset.
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- 187 MOSFET 52MHz.
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- 202 ETI-425 Complete System.
- 203 ETI-416 Amp.
- 204 PM 136 Amp 1972.
- 205 PM 137 Amp 1973.

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- 210 E T 100 100W.
- 211 P M 134 21W.
- 212 P M 138 20W.
- 213 Modular 200W.
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- 233 P M 123.
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- 238 Silicon Stereo.
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- 243 —

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TEMPERATURE CONTROL: Could you please advise if you have ever published any circuits or projects for a precision temperature control unit using IC's. I wish to control the temperature of an oven using 1kW elements around 38 degrees plus or minus 0.25 degrees. I have written to other magazines, but my letters remain unanswered. (J. R., Nhill, Vic.)

② We doubt whether we can be of much help, J. R. Our multi-purpose Sensor Switch (July 1974, File No 3/MS/48) will do this type of job using a thermistor, but we don't rate your chances of obtaining such a tolerance very high.

Playmaster 145 mixer . . . from p41

Twelve eight-way edge connectors with mounting brackets are required. We used a type kindly supplied by McMurdo (Australia) Pty Ltd, with part number 1333-11-17. These have one closed and one open mounting bracket. The closed mounting bracket (i.e., not slotted like the individual connectors) functions as a polarising key for the PC board inserted into it.

Refer to page 47 in the February article on the mixer and look at the photograph of the internal layout. This clearly shows the edge connectors with one closed and one open mounting bracket. Mount all the edge connectors in the same way, as shown in the photograph.

Screws, nuts and washers or pop-rivets and washers may be used to secure the

NO ADDRESS: We have to hand a letter from Mr A. Poluga requesting transparencies for the Playmaster 132 amplifier, with a remittance of 50c. However, no address is supplied. If Mr Poluga would write to us with his address and a further \$1.50 (the charge for this service is now \$2) we will send him the material requested.

MURPHY'S LAW: Enclosed is a rough copy of Murphy's Laws, as so often referred to in your magazine. I thought you might like to publish them. (N. T. Heatly, Qld.)

② Thank you N. T. and it certainly appears that you have conducted considerable research into this matter. We will certainly keep them in mind for publication—perhaps in an April issue!

edge-connector brackets to the mother board before soldering. If pop-rivets are used, take care not to crack the board when they are applied, especially when close to the edge.

Assuming that only four muting PC boards are required, as in the prototype, the space for the additional four edge connectors may be left vacant. In their place, 4.7uF tantalum or aluminium PC electrolytic capacitors are installed as shown on the mother board diagram.

As with the mixer board, all connections to the mother board are made via suitable PC stakes.

In the final article on the mixer, we shall complete the details of construction and setting up, and also publish the complete parts list.

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JOHN CARR & COMPANY PTY LTD.

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SYDNEY 2000

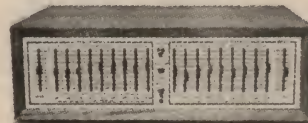
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A professional system at a domestic price

ETI 427 GRAPHIC EQUALISER



Features:

- 9 filters at octave intervals in each of two channels.
- Level control for each channel.
- $\pm 13\text{dB}$ range on each filter.
- Input voltage up to 3 volts.
- Output voltage up to 2 volts at less than .1% distortion.
- Frequency response 1.5Hz to 30KHz.

Comes with all coils prewound and a choice of either a timber cabinet or an attractive Marivplate cover making this kit ideal for professional P.A. or domestic Hi-Fi use. Complete kit (with Marvuplate cover) **\$96.00** P&P \$3.00

ETI 422 STEREO AMPLIFIER



High power — 50w RMS per channel less than .2% distortion. Complete Kit only **\$118.00**

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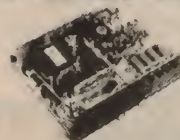
ETI 420 4-CHANNEL AMPLIFIER



features 15watts per channel with SQ decoding. Complete kit **\$129.00**

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ETI 423 ADD ON DECODER AMP



adapt your stereo to full 4 channel SQ operation **\$65.00** P&P \$2.00

Designed to provide reliable, high-speed and long life operation, OKI series MRD and URD relays are employed in a wide variety of applications including transistor, integrated circuit, general purpose control, telephone and telegraph switching and data processing equipment circuitry.

OKI relays are extremely small and lightweight, highly sensitive and of magnetically shielded construction to enable close proximity mounting with each other without interaction.

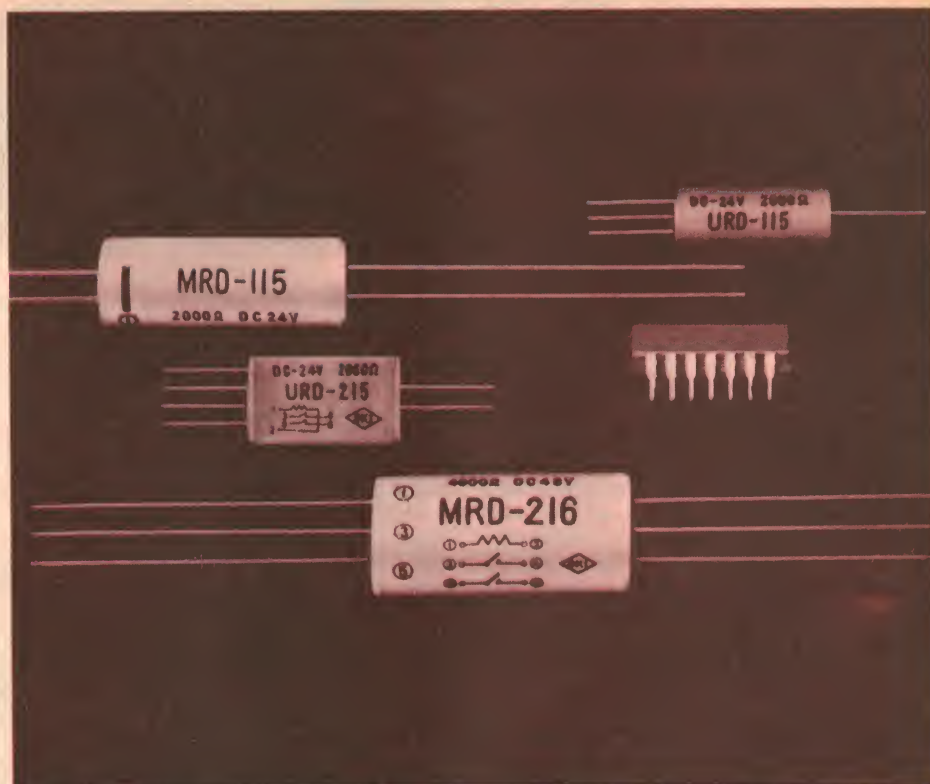
A wide range of packages are available: all are shock, vibration and humidity resistant. Series URD are miniaturised versions of the MRD and include a 14 pin DIL package. They are particularly suitable for switching circuits with high output/input ratios.


OKI relays incorporate miniature reed insert switches and coil assemblies. Switch contacts employed in the range are of rhodium or gold diffused material for maximum reliability and life.

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complete 3 chs \$210
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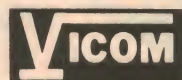
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TRIO QR-666 all band communications receiver
170 KHz to 30 MHz — \$275; kit \$230
LISTENER — 1 antenna 3-30MHz \$14.90.

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* TEST EQUIPMENT
* HAM ANTENNAE
* WHIPS
* QUALITY CO-AX SWITCHES
* BALUNS
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* DIGITAL CLOCKS
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FANTASTIC VALUE untested and ungraded transistors or diodes, genuine offer. Ideal for tradesmen, hobbyists & experimenters alike. Packs of 160 for \$2.00 plus 50c P&P. Interstate orders add 10c stamp duty. "Transistors" 22 Mitchell Ave, Boronia, 3155.

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SANYO GRAM MOTORS 100 volt AC brand new 50c ea. P/P 30c.

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2 1/4" diam. 22 ohm 50c ea.

2 3/4" diam. 8 ohm 75c ea.

3 1/2" diam. 8 ohm \$1.50 ea.

P & P 25c each.

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THERE are some things that can not be generally told—things you ought to know. Great truths are dangerous to some—but factors for personal power and accomplishment in the hands of those who understand them. Behind the tales of the miracles and mysteries of the ancients, lie centuries of their secret probing into nature's laws—their amazing discoveries of the hidden processes of man's mind, and the mastery of life's problems. Once shrouded in mystery to avoid their destruction by mass fear and ignorance, these facts remain a useful heritage for the thousands of men and women who privately use them in their homes today.

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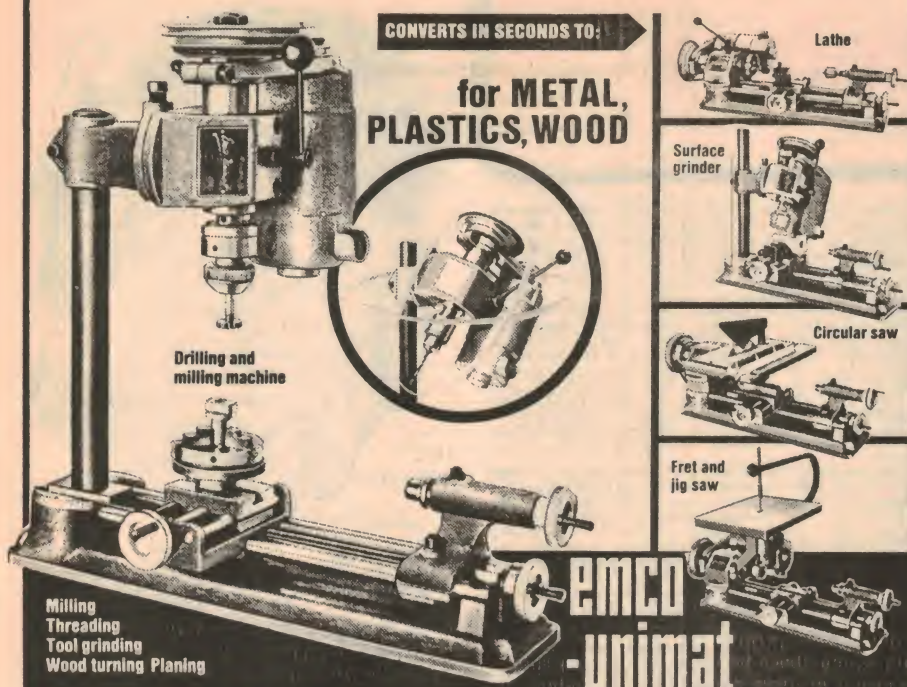
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Special unimat features:

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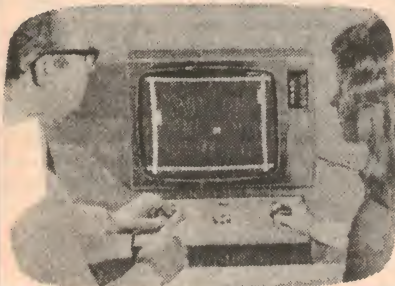
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PLAY THE GAME THAT'S SWEEPING THE NATION. YOU'VE SEEN IT IN PUBS, CLUBS AND ARCADES. NOW YOU CAN PLAY IT IN THE COMFORT OF YOUR OWN HOME. PLUGS INTO THE AERIAL OF YOUR VHF BLACK & WHITE OR COLOUR TELEVISION. DOES NOT INTERFERE WITH OTHER TV PROGRAMS. BUILT FROM 7 NEAT SUBSECTIONS. PURCHASE A COMPLETE KIT OR SUB-SECTION AT A TIME. WITH FULL INSTRUCTIONS.

Complete kit \$99.50 + P&P

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A PROFESSIONAL
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METER



Check stereo speaker systems, Industrial noise, Group sound

\$69.00 + P&P

N.C. 310 DELUXE
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- 1 Watt 3 channel C.B. transceiver
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- External aerial

Provision for external speaker, aerial and power supply. \$49.50. Post \$1 extra.



VHF
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110-136 MHz
couples to
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\$14.95
P & P 55c



New VORTEX STEREO
CASSETTE DECK
AS USED IN EA P/M 144
— \$29.50



USED
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VENNER
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240V 15 + 20 A CONTACTS
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32 piece metric brand new 1/2", 3/4" + 1/4" drive ratchet ext bar, T bar plug spanner etc in metal case only \$5.95 set. Post A 95c, B \$1.10, C \$1.25, D \$1.35.

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Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

\$26.00
(2 TELEPHONE SETS)

\$1 cartage to rail. Freight payable at nearest attended railway station.

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Sensitive type ex Air-Force, made by Pioneer USA. \$37.50. Post: A \$1.50, B \$1.60, C \$1.95, D \$2.75.

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Types TR 1934 100-125 MHz and TR 1936 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. **\$33.00**

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1 1/2 to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only

75c each or 10 for \$5
P & P 20c ea. or 10 for 55c.

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Genuine Eight Day Jewelled movement, sweep second hand and start of trip indicator. Dash mountings. Ideal for car rallies.

\$22.50 P & P \$1.05.

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Producermatic 2" professional end-less cartridge replay machines 2 track stereo with third cue track for machine control (auto-stop etc.). 600 OHM line level outputs. 240V AC operation. All silicone transistors 7 1/2 I.P.S. 19" rack mounting. 60Hz (240V) Model \$65; 50Hz (240V) Model \$90. Ideal for tape idents, background music, etc. \$1 cartage to rail. Freight payable at nearest attended railway station.

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Top Grade 2400' on 10 1/2" reels. Ideal Video Experimenting. Only **\$3.50** per reel.

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4 bank 25 position **\$4** each.
P & P A. 70c, B. 85c, C. \$1, D. \$1.10.

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100KHz 20MHz **\$95**

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

\$1.25 each. P & P 30c.

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Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7/16 inch.

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1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.

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Frequency Meters.

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Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On-Off Switch and indicator lamp. Size 1 1/2" Diam. 5" Long. Only

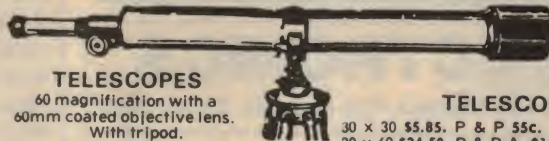
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45c P & P 20c

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25 x 30 **\$19.95** — 40 x 40 **\$28.95**
50 x 50 \$37.50, 60 x 60 \$75.00
P & P A. \$1.45, B. \$1.60, C. \$1.75, D. \$1.85.

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60 magnification with a 60mm coated objective lens. With tripod.

\$39.50
As illustrated.
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2-way radio, 7 transistor, PMG approved, set of 2 only **\$48.50**

1 watt, 11 transistor \$130.00 set of 2.

P & P A. \$1.45, B. \$1.60, C. \$1.75,
D. \$1.85.

SMALL COMPUTER PANELS

3in x 2in containing 2 valves, qty. of resistors, etc.

ONLY 75c P & P 30c.

ELECTRONIC FREQUENCY COUNTER

Austronic type DFC-4 240V 50 cycle 0-100KHz **\$150**

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New gunmetal body, Stainless Steel Shaft. Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5"

3/8" **\$19.95**
1/2" **\$22.75**
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AN URM 32 A 120 KHz to 1000 MHz, with two 40V power supply, **\$125.00**. \$1.00 cartage to rail, freight payable at nearest attended railway station.

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2 1/2in DIAM. 2in FL. **\$1.50** each. Or \$2.50 per pair. P & P 20c.

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Battery operated, transistorised. In good used condition \$27.50 Post A 70c, B 85c, C \$1, D \$1.25.

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C: SA, NT, Tas, New Guinea,
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BRAND NEW IN CARTONS

807	\$1.50CV850	\$1.50
65N7GT	95c1H6G	75c
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EF50	75c6AG5	80c
5Y3	\$1.996X4	\$1.00
2 x 2	75cVR64	75c
	VT4C	75c

P & P 30c

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36" dia. Ideal solar radio optical experimenting also decorating purposes. \$37.50 Sorry shop sales only.

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5 BPI \$5.50 each.
Post: A 85c, B \$1.10, C \$1.25, D \$1.35.

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30 x 30 \$5.85. P & P 55c.
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Five sizes: 1/8 inch, 3/16 inch, 1/4 inch 1 inch and 1 1/2 inches. With taper reamer. **\$17.95**

P & P A. \$1.45, B \$1.60, C. \$1.75
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Md. 11.....\$5.25 ea.
No. 19 TWO-WAY RADIOS.
Power supply, accessories, etc., \$35.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.
7 x 35 Wide Angle.....\$35.50
8 x 40 Wide Angle.....\$39.50
7 x 50.....\$31.50
10 x 50.....\$32.50
12 x 50.....\$33.65
20 x 50.....\$37.95

P & P A. \$1.45, B. \$1.60, C. \$1.75,
D. \$1.85.

3000 TYPE RELAYS

P.M.G. 200Ohms — 1'500Ohm
Coils \$2.50 each. P & P 30c.

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8 x 17 mag size of a rifle cartridge extends to 8". Only \$3.50 each, post 55c.

Cintel Oscillator and Electronic Counter, type 388.

\$250

SPECIAL lucky dip valve offer, 15 new valves in cartons for only \$2.95. We haven't got time to sort them, so you reap the benefit.

P & P A. 60c, B. 85c, C. \$1, D. \$1.10.

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1 1/2in diam. 1 1/2FL. 50c each.
P & P 20c

MULTIMETER

A compact and handy tester for workshop or lab where quick circuit checks are required

DC Voltage 5-2.5K (20,000 OHMS per volt) AC Voltage 10-1000V (10,000OH-MS per volt) DC Current 0-50 UA. 0-2.5 MA, 0-250 MA, Resistance 0-6 Megohms Capacitance 100 UUF to 1UF. Decibels — 20 to plus 22 DB. Complete with instructions.

Only \$15.95 ea. Post \$1.05.

EX ABC RECORDING TAPES TOP BRANDS

1/4" x 1200' on 7" reels. **\$2.50**
1/2" x 2400' on 10 1/2" reels. **\$4.95**
P & P A. 72c, B. \$1.05, C. \$1.15, D. \$1.30

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Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio, etc.

\$2.50 P & P 20c
200 MA 24 volt, 1/4in push movement. **\$2.50** P & P 20c.

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Battery and mirror illuminated 900x magnification. Complete with dissecting kit slides etc.

P & P A. \$1.45, B. \$1.60,
C. \$1.75, D. \$1.85. **\$29.95**

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No 10 set, 38 to 55MHz with hand piece \$22.50. Battery to suit \$3.50 extra.
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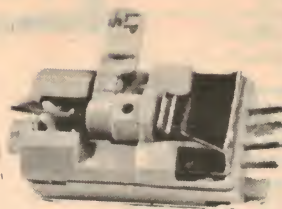
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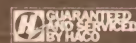
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